

**SPACE-RAY**  
INFRARED GAS HEATERS



## INSTALLATION AND OPERATION INSTRUCTIONS

**OWNER / INSTALLER:** For your safety this manual must be carefully and thoroughly read and understood before installing, operating or servicing this heater.

### INFRARED RADIANT TUBE HEATER

*Models:*

#### LTS SERIES

LTS 40  
LTS 50  
LTS 60  
LTS 75  
LTS 80  
LTS 90  
LTS 100  
LTS 110  
LTS 120  
LTS 125  
LTS 130  
LTS 140  
LTS 150  
LTS 160  
LTS 175

#### LTU SERIES

LTU 80  
LTU 90  
LTU 100  
LTU 110  
LTU 120  
LTU 125  
LTU 130  
LTU 140  
LTU 150  
LTU 160  
LTU 175

**!INSTALLER:** This manual is the property of the owner. Please present this manual to the owner when you leave the job site.

**▲WARNING:** Improper installation, adjustment, alteration, service, or maintenance can cause property damage, injury or death. Read the installation, operation and maintenance instructions thoroughly before installing or servicing this equipment.

**!IMPORTANT: SAVE THIS MANUAL FOR FUTURE REFERENCE.**

**SPACE-RAY®**

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### ! WHAT TO DO IF YOU SMELL GAS:

- ! Do not try to light any appliance. Extinguish any open flame. Open windows.
- ! Do not touch any electrical switch; do not use any telephone in your building.
- ! Immediately call your gas supplier from a neighbor's telephone. Follow the gas supplier's instructions.
- ! If you cannot reach your gas supplier, call the fire department.

This heater complies with ANSI Z83.6 (current standard) and CAN 1-2.16. Copies of the National Fuel Gas Code (ANSI Z223.1-latest edition) are available from the CSA at 8501 East Pleasant Valley Road, Cleveland, Ohio 44131 or 55 Scarsdale Road, Don Mills, Ontario M3B 2R3. All NFPA codes are available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

## 1) GENERAL INFORMATION

This heater is a self-contained infrared radiant tube heater for use in locations where flammable gases or vapors are not generally present (as defined by OSHA acceptable limits) and is intended for the heating of nonresidential spaces.

### INSTALLATION REQUIREMENTS

Installation of this heater must be in accordance with all applicable codes shown in the instructions and/or the local codes and authorities having jurisdiction. In Canada, the installation must conform to current CAN/CGA-B149.1/2 Installation Code in the absence of local codes. Heaters shall be installed by a licensed contractor or licensed installer. Clearances to combustibles as outlined in this manual should always be observed. In areas used for storage of combustible materials where they may be stacked below the heater, NFPA54 requires that the installer must post signs that will "specify the maximum permissible stacking height to maintain the required clearances from the heater to combustibles."

Every heater shall be located with respect to building construction and other equipment so as to permit access to the heater. Each installer shall use quality installation practices when locating the heater and must give consideration to clearances to combustible materials, vehicles parked below, lights, overhead doors, storage areas with stacked materials, sprinkler heads, gas and electrical lines, and any other possible obstructions or hazards. Consideration also must be given to service accessibility.

The heater, when installed in aircraft hangars and public garages, must be installed in accordance with ANSI/NFPA 409-latest edition (Standard for Aircraft Hangars), ANSI/NFPA 88a-latest edition (Standard for Parking Structures), and ANSI/NFPA 88b-latest edition (Standard for Repair Garages) with the following clearances:

- a. At least 10 feet above the upper surfaces of wings or engine enclosures of the highest aircraft that may be housed in the hangar and at least 8 feet above the floor in shops, offices, and other sections of hangars communicating with aircraft storage or service areas.
- b. At least 8 feet above the floor in public garages. **▲WARNING:** Minimum clearances marked on the heater must be maintained from vehicles parked below the heater.

### (FOR CANADA ONLY)

- a. Installation of this appliance is to be in accordance with latest edition of CAN 1-B149.1 (Installation Code for Natural Gas Burning Appliances and Equipment), and/or CAN B149.2 (Installation Code for Propane Gas Burning Appliances and Equipment).
- b. For installation in public garages or aircraft hangars, the minimum clearances from the bottom of the infrared heater to the upper surface of the highest aircraft or vehicle shall be 50 percent greater than the certified minimum clearance, but the clearance shall not be less than 8 feet.

Although these heaters may be used in many applications other than space heating (e.g., process heating), Gas-Fired Products, Inc. will not recognize the warranty for any use other than space heating.

This heater is for Indoor Installation and Covered Patio Installation only and can be used in either Vented or Unvented mode. The term Unvented actually means Indirect Vented. While the products of combustion are expelled into the building, national codes require ventilation in the building to dilute these products of combustion. This ventilation may be provided by gravity or mechanical means.

**This heater is not an explosion proof heater.** Where the possibility of exposure to volatile and low flash point materials exists, it could result in property damage or death. This heater must not be installed in a spray booth where the heater can operate during the spraying process. Consult your local fire marshal or insurance company.

**LTS Series Only:** Since straight tube heaters are always hotter at the control end than at the draft inducer end, always observe the minimum recommended mounting heights shown on the specification sheets and in Section 7 of this manual. Use U-tube configuration instead of straight tubes for spot or area heating (e.g., where a single heater is utilized for space heating).

**! WARNING:** Certain materials or objects, when stored under the heater, will be subjected to radiant heat and could be seriously damaged. Observe the Minimum Clearances to Combustibles listed in the manual and on the heater at all times.

**! ATTENTION:** SAVE THIS MANUAL FOR FUTURE REFERENCE.

## 2) LTU 80-175 SERIES — SPECIFICATIONS

Model No.	Btu/hr Input	Heat Exchanger Length	Total Heater Length	Flue Restrictor Plate I.D. & Part #	Orifice Size				Minimum Mounting Height	
					Natural Gas		Propane Gas		@ Horizontal	@ 45° Angle
LTU80	80,000	30'	17'-6½"	1-1/2" #42741050	#19	(0.166)	#38	(0.102)	12'	12'
LTU90	90,000			1-1/2" #42741050	#16	(0.177)	#36	(0.106)	12'	12'
LTU100	100,000			1-5/8" #42741060	#14	(0.182)	#33	(0.113)	12'	12'
LTU110	110,000			1-3/4" #42741070	#10	(0.194)	#31	(0.120)	14'	13'
LTU120	120,000			1-3/4" #42741070	13/64	(0.203)	1/8	(0.125)	14'	13'
LTU125	125,000			1-7/8" #42741080	#5	(0.206)	#30	(0.129)	14'	13'
LTU130	130,000			1-7/8" #42741080	#4	(0.209)	3.3mm	(0.130)	14'	13'
LTU125*	125,000	40'	22'-6½"	1-7/8" #42741080	#5	(0.206)	#30	(0.129)	14'	13'
LTU130*	130,000			1-7/8" #42741080	#4	(0.209)	3.3mm	(0.130)	14'	13'
LTU140*	140,000			2-1/32" #42741090	5.5mm	(0.216)	#29	(0.136)	15'	14'
LTU150*	150,000			2-1/32" #42741090	5.7mm	(0.224)	#28	(0.140)	15'	14'
LTU160*	160,000			2-1/4" #42741100	5.8mm	(0.228)	#27	(0.144)	15'	14'
LTU175*	175,000			2-1/4" #42741100	"C"	(0.242)	3.8mm	(0.150)	16'	15'

\* These models require the use of an additional 5' body section.

Type Gas:	Gas-Pipe Connection:	Tube Diameter:	Flue Connection:	Fresh Air Connection:	Electrical Supply:	Current Rating:
Natural or Propane	½" NPT (Female)	4"	6" Round	6" Round	120 Volt, 60Hz, 1 Phase	2.6 Amp

Fuse Rating:		Ignition System:
In-line: 2 Amp 250V (for 24V Circuit)	Spark Module: 3 Amp 250V (for 24V Circuit)	Direct Spark (with 30-second prepurge period)

## 3) LTU 80-175 SERIES — PACKING LIST

### A) Control/Draft Inducer Package

	QTY
Control Box Assembly (Refer to Package Part Numbers at right)	1
Draft Inducer & Junction Box Assembly (Package Part Numbers at right)	1
Flue Restrictor Plate (attached to blower housing with 3 locknuts)	1
Plastic Vacuum Air Tube (#03988120)	1
4" x 6" Starting Collar (#42892000)	1
Control Fastener Kit (#42907010)	1
containing: #8-32 Screws (#02166010) & Nuts (#02127030)	2 ea.
¼ - 20 Locknuts (#02167010)	6
Tube Flange Gasket (#42921000)	2
Installation & Operation Instructions (#43155010)	1

### CONTROL/DRAFT INDUCER PACKAGE NUMBERS:

MODEL NO.	PART NO.
— NATURAL GAS —	
LTU80-N5	#42883010
LTU90-N5	#42883030
LTU100-N5	#42883050
LTU110-N5	#42883070
LTU120-N5	#42883090
LTU125-N5	#42883110
LTU130-N5	#42883130
LTU140-N5	#42883190
LTU150-N5	#42883210
LTU160-N5	#42883230
LTU175-N5	#42883250
— PROPANE GAS —	
LTU80-L5	#42883020
LTU90-L5	#42883040
LTU100-L5	#42883060
LTU110-L5	#42883080
LTU120-L5	#42883100
LTU125-L5	#42883120
LTU130-L5	#42883140
LTU140-L5	#42883200
LTU150-L5	#42883220
LTU160-L5	#42883240
LTU175-L5	#42883260

**B) LTU 80-175 Body Package Descriptions** (Package Number is Indicated on the outside of each corresponding carton.)

■ **LTU 80-130** (30' TUBE)

Each 30' LTU tube heater contains one 15' Body Package as listed below.

- (1) #42881000, 15 Ft. Body Package (QTY=1) containing:
- a) #42914000, Pre-assembled 15' ALC steel U-tube (two 24-hole flanges) with Reflector (QTY=1)
  - b) #42895000, Control End Reflector (QTY=1)
  - c) #42896000, Foot End Reflector (QTY=1)
  - d) #02266010, Speed Clips (QTY=20)

■ **LTU 125-175** (40' TUBE)

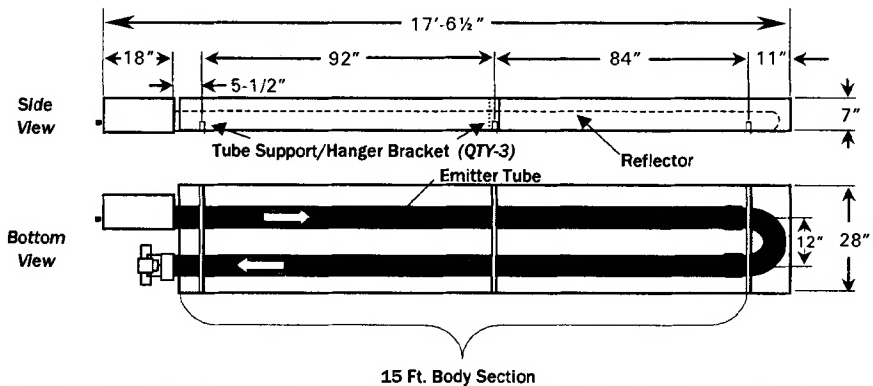
Each 40' LTU tube heater contains one 15' Body Package and one 5' Body Package as listed below.

- (1) #42881000, 15 Ft. Body Package (QTY=1) (same as listed above)
- (2) #42882000, 5 Ft. Body Package (QTY=1) containing:
- a) #42915000, Pre-assembled 5' ALC steel tube (two 24-hole flanges) with Reflector (QTY=1)
  - b) #42907020, Body Fastener Kit (QTY=1) containing: #02167010, 1/4-20 Locknuts (QTY=12)  
#02259000, 1/4-20 Machine Screws (QTY=12)  
#02266010, Speed Clips (QTY=2)
  - c) #42921000, Tube Flange Gasket (QTY=2)

**4) LTU 80-175 SERIES — DIMENSIONS**

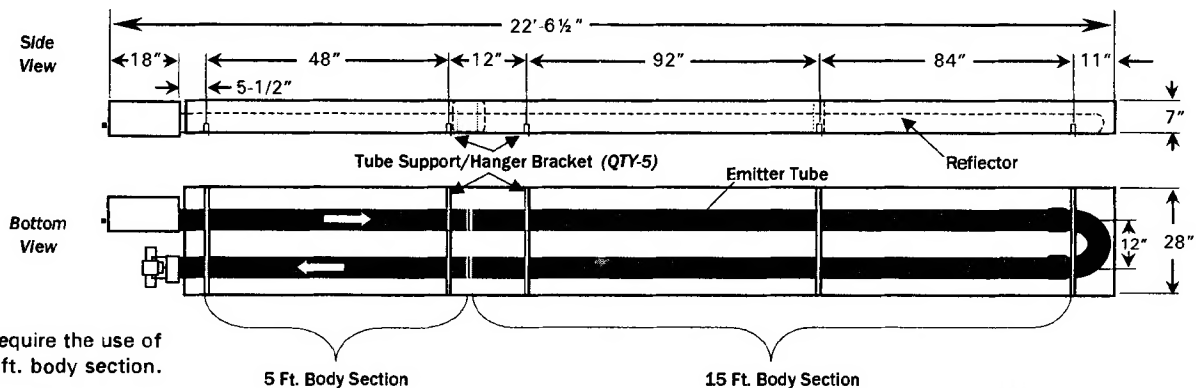
**MODELS:**

LTU 80-30  
LTU 90-30  
LTU100-30  
LTU110-30  
LTU120-30  
LTU125-30  
LTU130-30

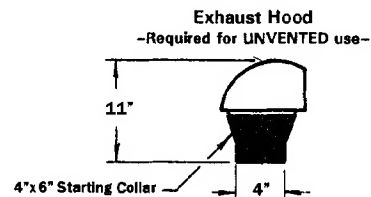
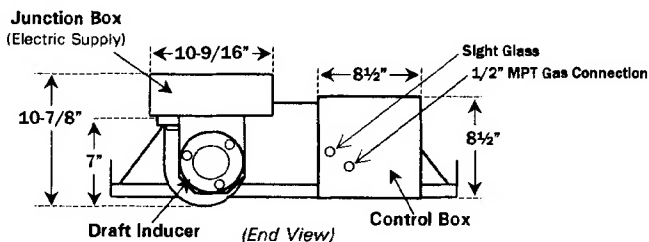


**\*MODELS:**

LTU125-40  
LTU130-40  
LTU140-40  
LTU150-40  
LTU160-40  
LTU175-40

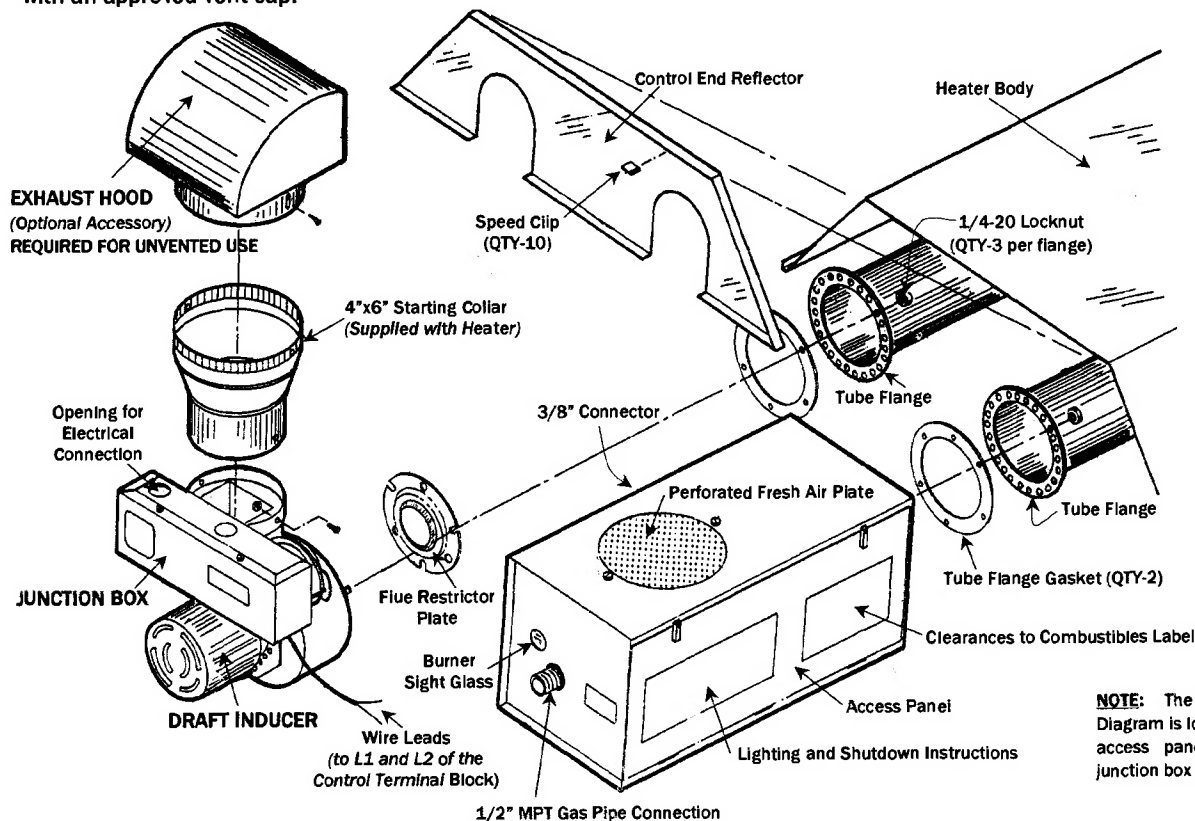


\*These models require the use of an additional 5 ft. body section.



## 5) LTU 80-175 SERIES — HEATER ASSEMBLY

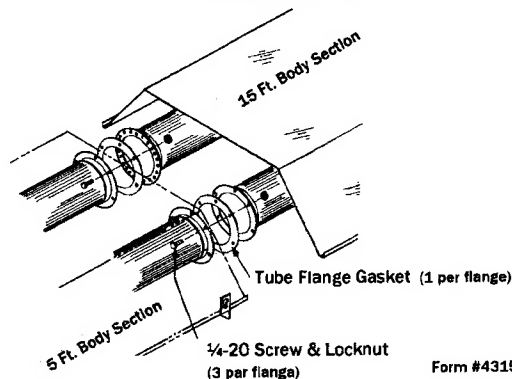
1. Place the flanges of the control end reflector (packaged with the 15' body section) flush with the end of the body reflector. Secure by sliding the speed clips onto the reflector edges. Evenly space the speed clips on the sides and top of the reflector to provide a snug fit. Place the foot end reflector (not shown) on the opposite end of the body reflector and secure as described above. **DO NOT** relocate the tube support/hanger brackets, especially at the control end of the heater. Slide the reflector toward the U-bend and leave a 3" space between the control end reflector and the control box.
2. Attach the control box and gasket to the right hand tube flange and secure with the 1/4-20 locknuts. The control box must be mounted with the perforated fresh air plate on top, facing the ceiling.
3. Attach the draft inducer assembly and gasket to the left hand tube flange and secure with the 1/4-20 locknuts. A flue restrictor plate is attached to the draft inducer weld stud. Make sure this remains in place while the draft inducer is being attached to the heater body. **NOTE:** The draft inducer can be mounted in either a vertical, a 45° or a horizontal position. Refer to the diagram on multiple hanging and draft inducer positions (Section 16).
4. Take the end of the SJO cable from the junction box and insert it through the 3/8" connector of the control box. Connect the wire leads of the SJO cable to "1" and "2" of the terminal block. Refer to the Connection Wiring Diagram (Section 22). Tighten the screws of the connector.
5. Place the starting collar on the draft inducer and secure with the #8-32 screws and nuts.
6. If the heater is for UNVENTED use, place the exhaust hood (supplied as an accessory) on top of the starting collar. Secure with the #8 sheet metal screws. The exhaust hood must be mounted only in an upright position and directed towards the reflector body.
7. If heater is to be vented to the outside of the building, place the flue pipe directly onto the starting collar and terminate with an approved vent cap.



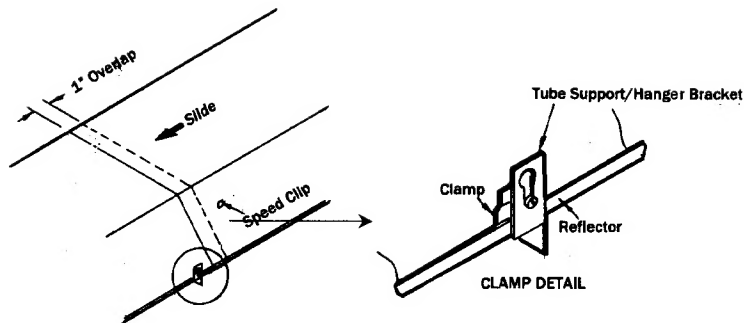
## 6) LTU 125-175 SERIES — JOINING OF BODY SECTIONS

**Models LTU125-175** → These models require the use of an additional 5' body section, as shown on the heater dimension sheet. Follow the instruction below for joining these sections.

1. Join the tube flanges of the body sections together with the gaskets in between. Secure the flanges with the 1/4-20 screws and locknuts provided in the 5' body package.
2. Pull the reflector onto the 15' body section over the reflector on the 5' body section to maintain approximately an one-inch overlap. Secure the reflectors by sliding the speed clips on the reflector edges as show in the diagram. One speed clip is required for each side of the reflector.



- Tighten the reflector clamps once the reflectors are secured with the speed clips.
3. Assemble the control box, draft inducer, and other components as previously described in the heater assembly instructions.



## 7) LTS 40-175 SERIES — SPECIFICATIONS

Model No.	Btu/hr Input	Flue Restrictor Plate I.D. & Part #		Orifice Size			Minimum Mounting Height	
				Natural Gas		Propane Gas	@Horizontal	@45° Angle
LTS40	40,000	1"	#42741040	#31	(0.120)	#49	(0.073)	10 feet
LTS50	50,000	1-1/8"	#42741030	3.3mm	(0.130)	#46	(0.081)	11 feet
LTS60	60,000	1-7/32"	#42741020	#27	(0.144)	#43	(0.089)	12 feet
LTS75	75,000	1-7/16"	#42741010	#20	(0.161)	#39	(0.099)	13 feet
LTS80	80,000	1-1/2"	#42741050	#19	(0.166)	#38	(0.102)	13 feet
LTS90	90,000	1-1/2"	#42741050	#16	(0.177)	#36	(0.106)	13 feet
LTS100	100,000	1-5/8"	#42741060	#14	(0.182)	#33	(0.113)	13 feet
LTS110	110,000	1-3/4"	#42741070	#10	(0.194)	#31	(0.120)	14 feet
LTS120	120,000	1-3/4"	#42741070	13/64	(0.203)	1/8	(0.125)	14 feet
LTS125	125,000	1-7/8"	#42741080	#5	(0.206)	#30	(0.129)	14 feet
LTS130	130,000	1-7/8"	#42741080	#4	(0.209)	3.3mm	(0.130)	14 feet
LTS140	140,000	2-1/32"	#42741090	5.5mm	(0.216)	#29	(0.136)	15 feet
LTS150	150,000	2-1/32"	#42741090	5.7mm	(0.224)	#28	(0.140)	15 feet
LTS160	160,000	2-1/4"	#42741100	5.8mm	(0.228)	#2127	(0.144)	15 feet
LTS175	175,000	2-1/4"	#42741100	"C"	(0.242)	3.8mm	(0.150)	15 feet

Type Gas:	Gas-Pipe Connection:	Tube Diameter:	Flue Connection:	Fresh Air Connection:	Electrical Supply:	Current Rating:
Natural or Propane	1/2" NPT (Female)	4"	6" Round *	6" Round *	120 Volt, 60Hz, 1 Phase	2.6 Amp

Fuse Rating:		Ignition System:
In-line: 2 Amp 250V (for 24V Circuit)	Spark Module: 3 Amp 250V (for 24V Circuit)	Direct Spark (with 30-second prepurge period)

\* 4" Round for Models LTS40-75

## CONTROL/DRAFT INDUCER PACKAGE NUMBERS:

MODEL NO.	PART NO.
— NATURAL GAS —	
LTS40-N5	#43187010
LTS50-N5	#43187030
LTS60-N5	#43187050
LTS17-N5	#43187070
LTS80-N5	#43216010
LTS90-N5	#43216030
LTS100-N5	#43216050
LTS110-N5	#43216070
LTS120-N5	#43216090
LTS125-N5	#43216110
LTS130-N5	#43216130
LTS140-N5	#43216150
LTS150-N5	#43216170
LTS160-N5	#43216190
LTS175-N5	#43216210
— PROPANE GAS —	
LTS40-L5	#43187020
LTS50-L5	#43187040
LTS60-L5	#43187060
LTS75-L5	#43187080
LTS80-L5	#43216020
LTS90-L5	#43216040
LTS100-L5	#43216060
LTS110-L5	#43216080
LTS120-L5	#43216100
LTS125-L5	#43216120
LTS130-L5	#43216140
LTS140-L5	#43216160
LTS150-L5	#43216180
LTS160-L5	#43216200
LTS175-L5	#43216220

## 8) LTS 40-175 SERIES — PACKING LIST

### A) Control/Draft Inducer Package

	QTY
Control Box Assembly (Refer to Package Part Numbers at right)	1
Draft Inducer & Junction Box Assembly (Package Part Numbers at right)	1
Flue Restrictor Plate (attached to blower housing with 3 locknuts)	1
Plastic Vacuum Air Tube (#03988120)	1
4" x 6" Starting Collar (#42892000)	1
Control Fastener Kit (#42907050)	1
containing: #8-32 x 3/8" Screws (#02166010) & Nuts (#02127030)	2 ea.
1/4" - 20 Locknuts (#02167010)	6
Speed Clips (#02266010)	8
Tube Flange Gasket (#42921000)	2
Installation & Operation Instructions (#43155010)	1

**B) LTS 40-175 Body Package Descriptions** (Package Number is indicated on the outside of each corresponding carton.)

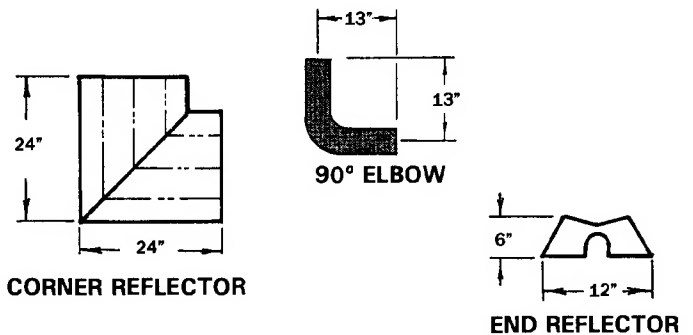
SYSTEM LENGTH→		15'	20'	25'	30'	35'	40'	45'	50'
(1)	<b>#43337040, Start/End 10 Ft. Body Package</b> – includes:	Quantity =							
	a) #43182060, Pre-assembled 10' ALC Steel Tube (one 24-hole flange) with reflector (QTY=1)	1	2	1	2	1	2	1	2
	b) #30462980, Tube Coupling (QTY=1)								
	c) #42907140, Reflector/Coupling Fastener Kit (QTY=1)								
	containing: #02189020, Self-drilling screws (QTY=2)								
	#02266010, Speed Clips (QTY=2)								
(2)	<b>#43337010, 10 Ft. Body Package</b> – includes:	Quantity =							
	a) #43182040, Pre-assembled 10' ALC Steel Tube (no flanges) with reflector (QTY=1)	-	-	1	1	2	2	3	3
	b) #30462980, Tube Coupling (QTY=1)								
	c) #42907140, Reflector/Coupling Fastener Kit (QTY=1)								
	containing: #02189020, Self-drilling Screws (QTY=2)								
	#02266010, Speed Clips (QTY=2)								
(3)	<b>#43336030, Ending 5 Ft. Body Package</b> – includes:	Quantity =							
	a) #43181050, Pre-assembled 5' ALC Steel Tube (one 24-hole flange) with reflector (QTY=1)	1	-	1	-	1	-	1	-
	b) #30462980, Tube Coupling (QTY=1)								
	c) #42907140, Reflector/Coupling Fastener Kit (QTY=1)								
	containing: #02189020, Self-drilling Screws (QTY=2)								
	#02266010, Speed Clips (QTY=2)								

**C) #43208010, Elbow Accessory Package**

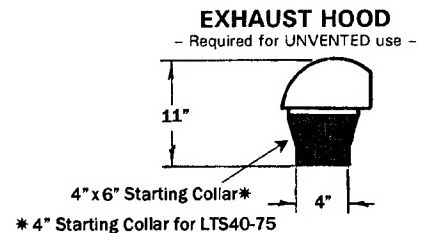
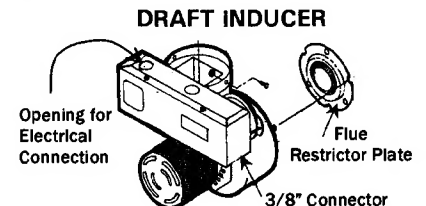
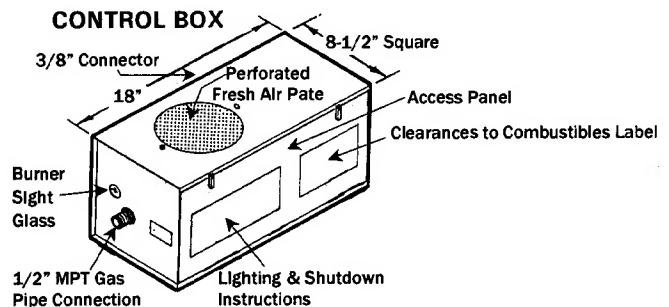
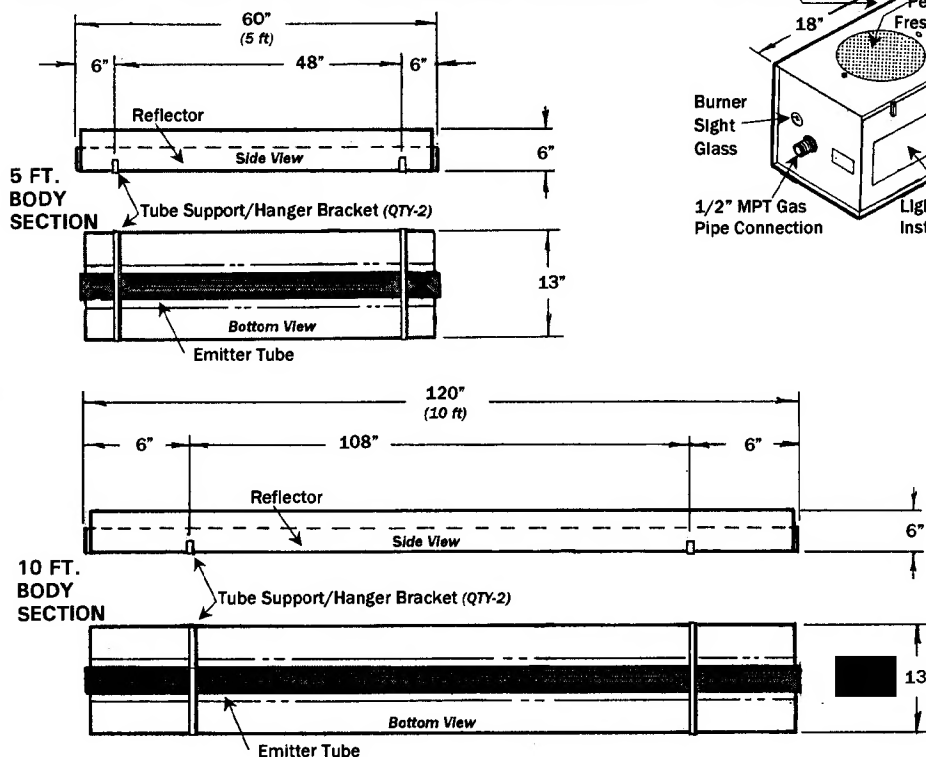
	QTY
#43175001, Elbow.....	1
#02189020, #20-16 x ½ Self-drilling Screws.....	2
#30462980, Tube Coupling.....	1

**D) #43342000, Corner Reflector Accessory Package**

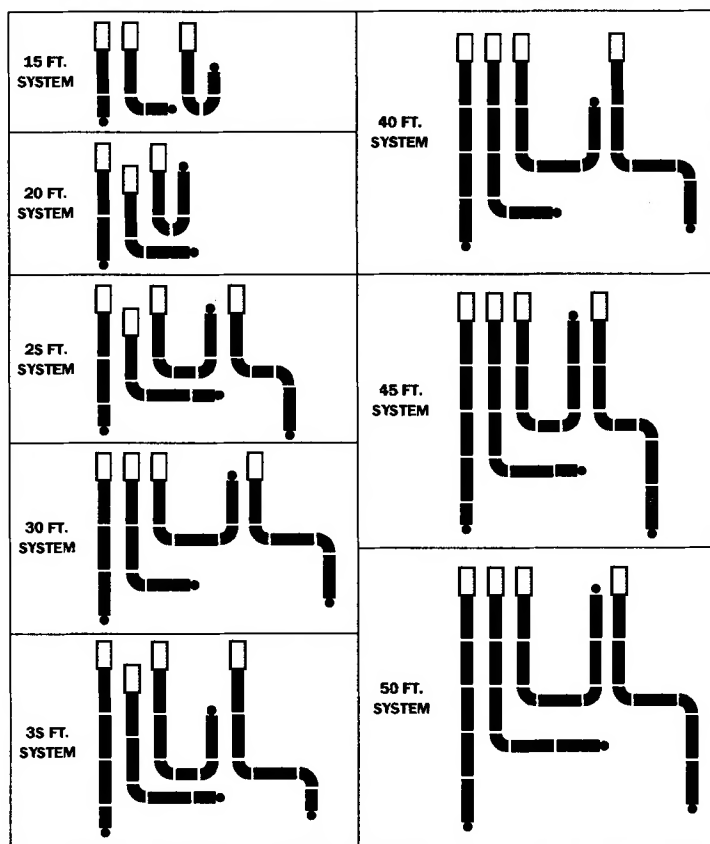
	QTY
#43345000, Corner Reflector Assembly.....	1
#02266010, Speed Clips.....	4



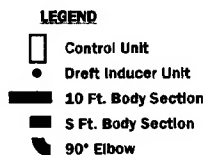
**9) LTS 40-175 SERIES — DIMENSIONS**



## 10) LTS 40-175 — TYPICAL LAYOUTS



- ☒ Straight
- ☒ L Shape
- ☒ U Shape
- ☒ Z Shape



MODEL	EMITTER LENGTH	
	Min.	Max.
LTS 40	15 Ft.	20 Ft.
LTS 50	15 Ft.	30 Ft.
LTS 60	20 Ft.	30 Ft.
LTS 75	20 Ft.	30 Ft.
LTS 80	30 Ft.	40 Ft.
LTS 90	30 Ft.	40 Ft.
LTS100	30 Ft.	40 Ft.
LTS110	30 Ft.	40 Ft.
LTS120	30 Ft.	40 Ft.
LTS125	30 Ft.	50 Ft.
LTS130	30 Ft.	50 Ft.
LTS140	40 Ft.	50 Ft.
LTS150	40 Ft.	50 Ft.
LTS160	40 Ft.	50 Ft.
LTS175	40 Ft.	50 Ft.

### NOTES:

- 1) The control unit must be connected directly to a 10 ft. aluminized steel body section in all configurations.
- 2) Joining of two 90° elbows directly together to form a "Z" shape is NOT permitted.
- 3) Any configuration of components not shown in the illustrations may be used except as noted in 1 and 2 above.

## 11) LTS 40-175 — HEATER ASSEMBLY/ JOINING OF BODY SECTIONS

During field assembly of the LTS series heater body sections, the recommended procedure is as follows:

1. Before hanging heater sections, first determine the actual layout of the system (see Section 10 for details). Consideration must also be taken for flue pipe, fresh air ducting, gas piping, etc., before hanging the heater. Typical suspension methods are shown in Section 17. **DO NOT** relocate the tube support/hanger brackets, especially at the control end of the heater.
2. Hang each heater body section individually. **DO NOT** attach the heater body sections together on the ground and attempt to hang the entire system at one time. The weight of the individual heater body sections can cause misalignment and damage to the heater.
3. Join the body sections together and secure with tube couplings as follows:

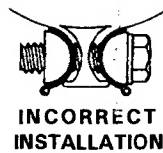
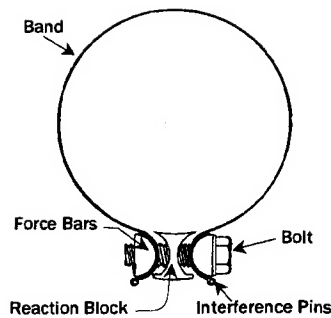
**▲WARNING:** The following coupling tightening instructions must be followed properly to avoid future problems.

- a. Place the compression coupling over the end of the tube from one body section, with the tightening bolts located on the bottom and facing the installer. **NOTE:** There is a small hole at the centerline of the coupling that can be used to sight the end of the tube.
- b. Partially tighten the bolt nearest the end of the tube (approximately half closed).
- c. Slide the ends of the tube from the opposite body section into the coupling. Make sure both tube ends are butted together.
- d. Finish tightening both bolts to 40-60 ft.lbs. torque to ensure a complete seal.
- e. Check to ensure that the hardware is completely closed and that the band is seated on the reaction block and interference pins as illustrated below.
- f. Check to see if the reaction block is firmly seated on the tube.
- g. Self-drilling screws are provided to prevent any possible movement of the tubes from the coupling. Install the screws as shown using an electric or air screwdriver with approximately 2500 rpm speed. Pre-punched holes in the coupling make it easier to install these self-drilling screws.
- h. Once all the heater body sections are attached, make sure that the heater system is level. If it is not, slight adjustments can be made using the turnbuckles. (See Section 17.)

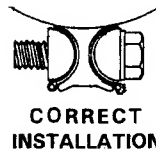
**!IMPORTANT: NEVER REUSE A COUPLING.**

Always install a new coupling only and torque as per instructions above and the diagrams that follow.

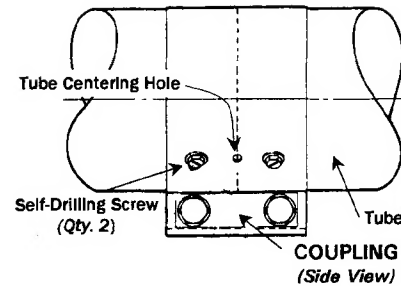




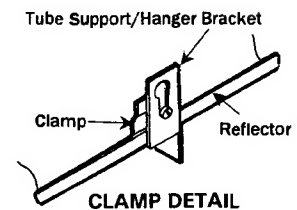
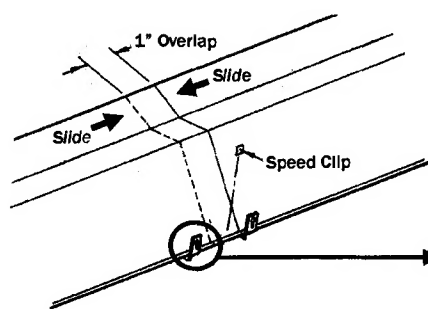
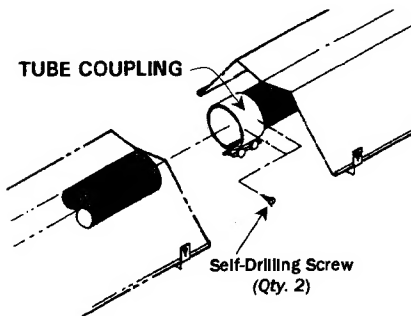
INCORRECT  
INSTALLATION



CORRECT  
INSTALLATION



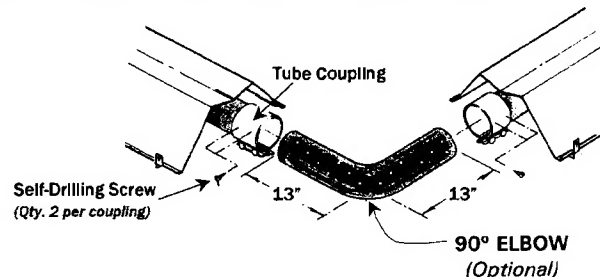
COUPLING  
(Side View)



- The tube at the coupling joints must be covered. Slide the reflectors together and provide a one-inch overlap. (This will allow for the natural expansion and contraction of the heater when in operation.) Secure reflectors together by sliding speed clips on the reflector joint edges. One speed clip is required for each side of the reflector. Tighten the reflector clamps. **!DO NOT OVER-TIGHTEN! Make sure that the reflector can slide under the clamp during heater operation.**

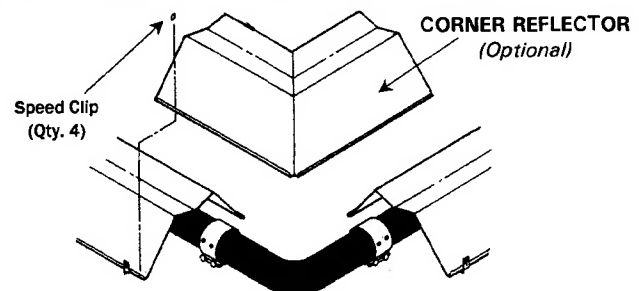
## 12) ADDING OPTIONAL 90° ELBOW (LTS ONLY)

- The optional 90° elbow must be located a minimum of 10 ft. after the control box.
- Hang the body sections in a 90° ("L") shaped pattern. Allow spacing for the elbow. The distance from one end of the elbow to the centerline of the opposite leg is 13" as shown.
- Join the tube ends of the body sections and the elbow together and secure with tube couplings as described in Section 11.



## 13) ADDING OPTIONAL CORNER REFLECTOR (LTS ONLY)

- Place the corner reflector over the reflectors of both body sections.
- Secure by sliding speed clips on the reflector edges. One speed clip is required for each side of reflector.
- The corner reflector can be used only when the long axis of the heater is level and mounted in a horizontal position.

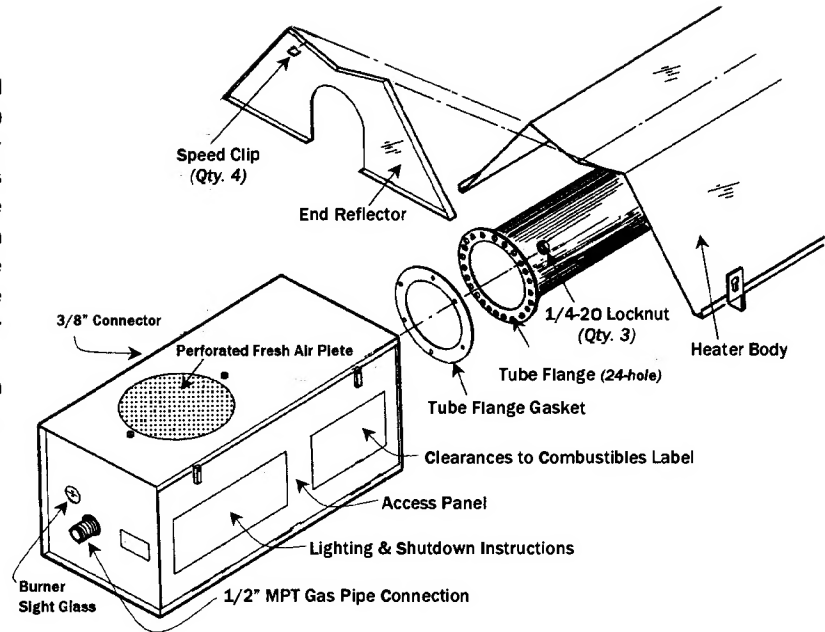


## 14) ATTACHING CONTROL BOX ASSEMBLY

- Attach the control box and gasket to end of tube flange and secure with 1/4-20 locknuts. **NOTE: The control box must be mounted to a 10 ft. aluminized steel body section regardless of configuration used.**
- A 3/8" connector is located on the left side of the control cabinet to provide strain relief for field wiring to the draft inducer junction box (refer to Section 22 on Electrical Connections and Connection Wiring Diagram for wiring between the control box and the draft inducer.)

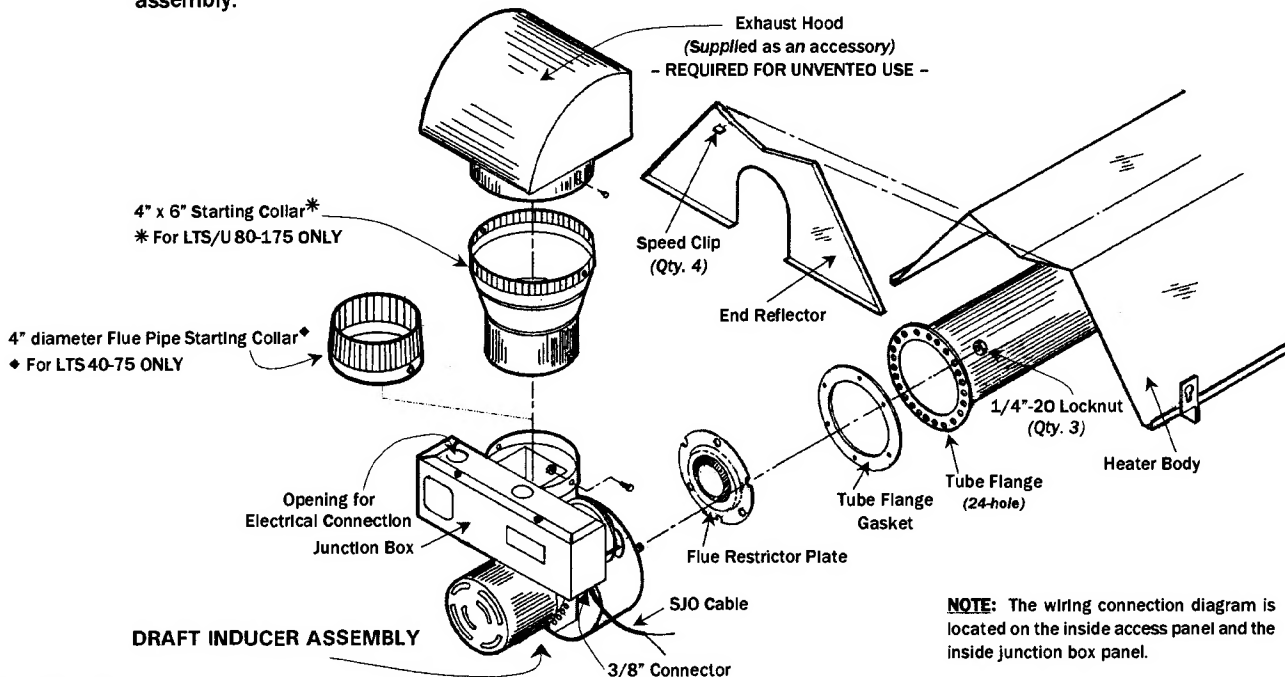
3. Assemble the end reflector (packaged in the control/draft inducer package) flush with the end of the main body reflector. Secure by sliding speed clips onto the reflector edges. Evenly space the speed clips on the sides (one each side) and top (two required) of the reflectors to provide a snug fit. Leave a 3" space between the end reflector and the control box assembly.
4. The control box must be mounted with the perforated fresh air plate on top, facing the ceiling.

**NOTE:** The wiring connection diagram is located on the inside access panel end on the inside junction box panel



## 15) ATTACHING DRAFT INDUCER ASSEMBLY

1. Attach the draft inducer assembly and gasket to end of tube flange and secure with 1/4-20 locknuts. A flue restrictor plate is loosely attached to the draft inducer weld studs. Make sure this remains in place while the draft inducer is being attached to the heater body. **NOTE:** The draft inducer can be mounted in a vertical, a 45°, or a horizontal position. Refer to the diagram on Multiple Hanging and Draft Inducer Positions (Section 16).
2. Disconnect the piece of SJO cable (if equipped) from the junction box and discard. This is used only on LTU series heaters.
3. The 3/8" connector used to hold the SJO cable will remain to provide strain relief for field wiring of the control box and the draft inducer (refer to the Electrical Connections and Connection Wiring Diagram for wiring between the control box and the draft inducer in Section 22).
4. Place the starting collar on the draft inducer and secure with #8-32 screws and nuts.
5. If heater is to be VENTED to the outside of the building, place the flue pipe directly onto the starting collar and secure with #8 sheet metal screws. Terminate with an approved vent cap.
6. If the heater is for UNVENTED use, place the exhaust hood (supplied as an accessory) on top of the starting collar. Secure with #8 sheet metal screws. The exhaust hood must be mounted only in an upright position and directed toward the reflector body.
7. Assemble the end reflector (packaged in the control draft inducer package) flush with the end of the main body reflector. Secure by sliding speed clips onto the reflector edges. Evenly space the speed clips on the sides (one each side) and top (two required) of the reflectors to provide a snug fit. Leave a 3" space between the end reflector and the draft inducer assembly.



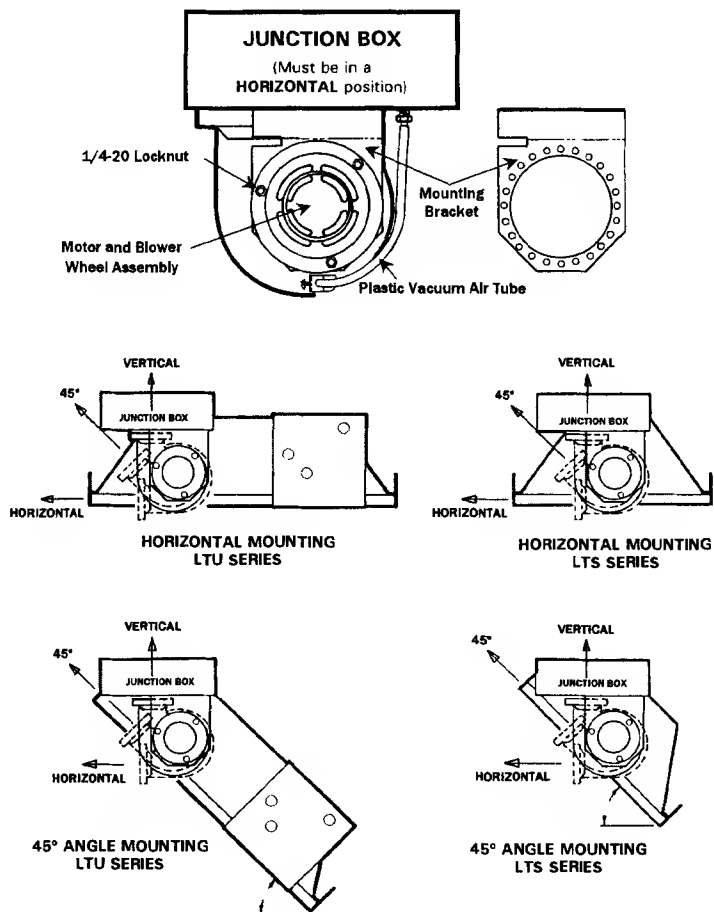
**NOTE:** The wiring connection diagram is located on the inside access panel and the inside junction box panel.

## 16) MULTIPLE HANGING & DRAFT INDUCER POSITIONS

The heater can be mounted horizontally or at an angle of 45° maximum from horizontal. Make sure the long axis of heater is level.

Multiple draft inducer positions can also be used as shown in the diagrams. This allows for the desired configuration of flue venting. Regardless of the position chosen, the junction box must remain horizontal as shown. This may be achieved as follows:

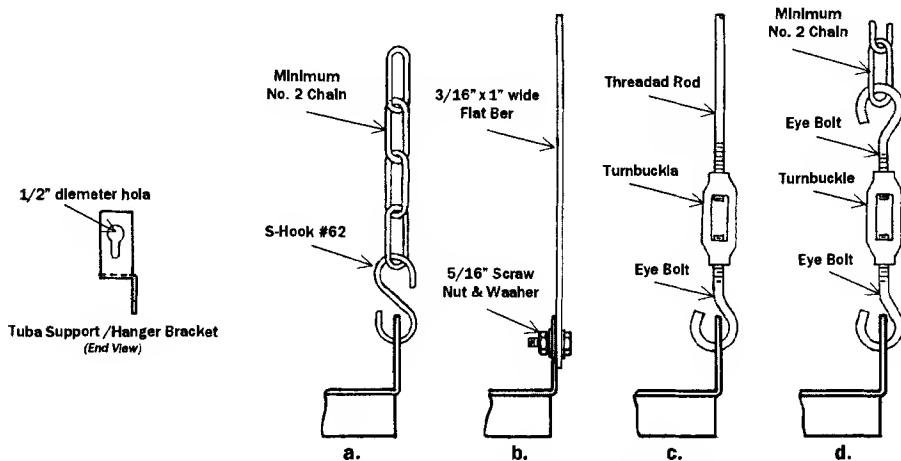
1. Remove the three (3) 1/4-20 locknuts securing the motor and blower wheel assembly.
2. Pull the motor and blower wheel assembly with the motor plate slightly from the end of the housing studs. Use care not to damage the motor leads.
3. Rotate the junction box assembly to the upright position using the multi-hole mounting bracket.
4. Replace the motor and blower assembly. Tighten the locknuts.
5. Horizontal and 45° draft inducer positions can allow the plastic vacuum air tube to sag. The air tube should be shortened to prevent a downward sag that could allow condensation build-up in the tube.



## 17) TYPICAL SUSPENSION METHODS

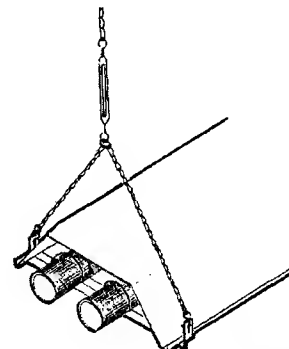
Various means of suspending the heater can be used. See the following drawings for typical examples.

1. Use only noncombustible materials for hangers and brackets.
2. A minimum No. 2 chain with a working load limit of 115 lbs. is required.
3. Turnbuckles should be used with chains to allow leveling of the heater. All "S" hooks and eye bolts must be manually crimped closed by the installer.
3. When using rigid means for heater suspension (rod, flat bar, etc.) provide sufficient lengths or swing joints to compensate for expansion. See Figures b and c.
4. Heaters subject to vibration must be provided with vibration isolating hangers.
5. Heaters must not be supported by gas or electric supply lines and must be suspended from a permanent structure with adequate load capacity.



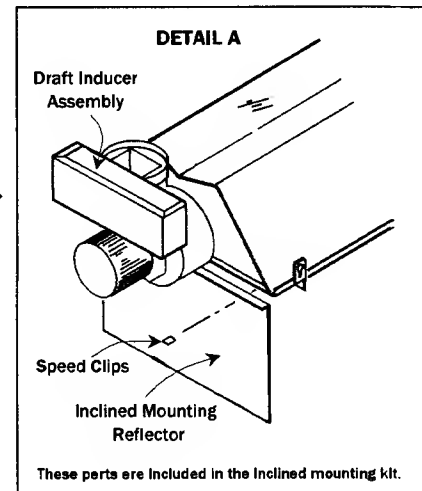
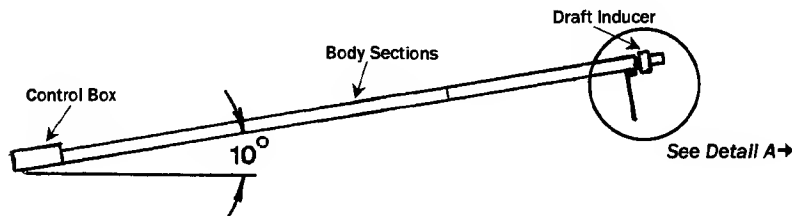
TYPICAL SUSPENSION METHODS

Space-Ray recommends that the body sections be hung by chains with turnbuckles. This will allow slight adjustments after assembly and heater expansion/contraction during operation.



## 18) INCLINED MOUNTING INSTRUCTIONS (LTS ONLY)

These inclined mounting instructions relate to LTS series heaters (straight tubes) that **do not** utilize the elbow accessory. These heaters have been tested and design certified by the CSA for 2"/12" pitch (10°) inclined mounting of the heater from the control box to the draft inducer assembly as shown in the following diagram.



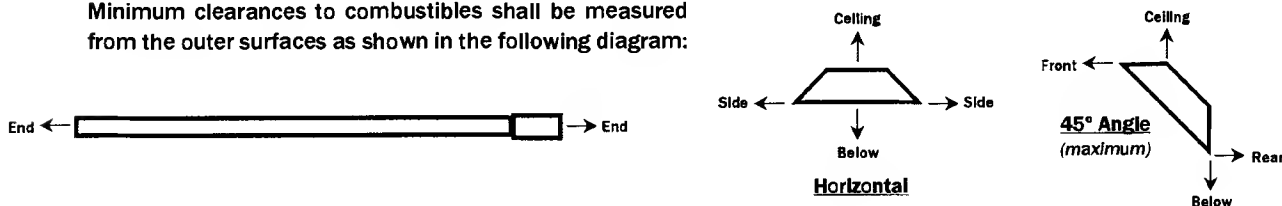
The purpose of this type mounting is to allow the heater to be mounted in the plane of the roof (particularly in modern "Butler" type buildings frequently used today). This will typically put the heater out of the way while still providing the warmth and comfort. The heater can be inclined upwards from the control box to the draft inducer at a distance of 2 inches up for every linear foot of the heater length. The total rise for each draft inducer is tabulated in the table below:

TOTAL DRAFT INDUCER HEIGHT ABOVE HORIZONTAL FOR 2"/12" PITCH INSTALLATIONS								
Models	Tube Length							
	15 Ft.	20 Ft.	25 Ft.	30 Ft.	35 Ft.	40 Ft.	45 Ft.	50 Ft.
LTS 40-LTS 75	30"	40"	50"	60"				
LTS 80-LTS120				60"	70"			
LTS125-LTS130				60"	70"	80"	90"	100"
LTS140-LTS175						80"	90"	100"

The heater is subject to all other requirements presented in these Installations Instructions, particularly the Clearances to Combustibles. If you plan to use this type of installation, order the Space Ray Inclined Mounting Kit, Part #43238000.

## 19) MINIMUM CLEARANCES TO COMBUSTIBLES

Minimum clearances to combustibles shall be measured from the outer surfaces as shown in the following diagram:



MINIMUM CLEARANCES TO COMBUSTIBLES						
Model No.	Mounted Horizontally				Angle Mounted at 45°	
	Sides	Ceiling*	Below	Ends	45° Front	45° Rear
LTS/LTU 40, 50	27"	6"	40"	30"	48"	12"
LTS/LTU 60, 75	27"	6"	60"	30"	48"	12"
LTS/LTU 80, 90	52"	6"	84"	30"	52"	12"
LTS/LTU 100	66"	6"	88"	40"	66"	20"
LTS/LTU 110, 120, 125, 130	66"	6"	101"	41"	66"	20"
LTS/LTU 140, 150, 160, 175	84"	6"	106"	48"	84"	24"

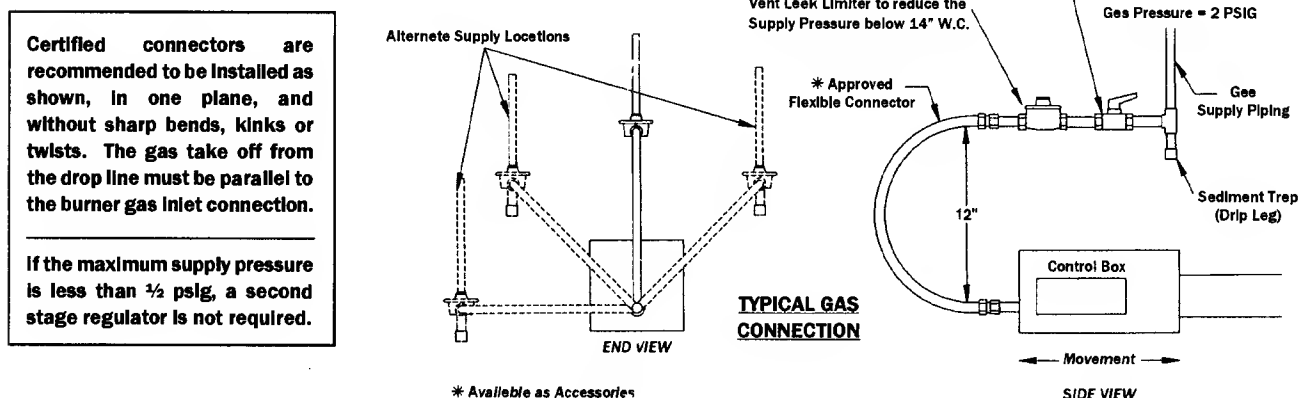
\* When used indirect vented, the clearance must be: 12" for LTS40-75 and 18" for LTS/LTU80-175. If optional corner reflectors are not used, the clearance must be 18"

**NOTE:** The clearances specified above must be maintained to combustibles and other materials that may be damaged by temperatures 90°F above ambient temperature. Clearances to combustibles are posted on the control box. In areas used for storage of combustible materials where they may be stacked below the heater, NFPA54 requires that the installer must post signs that will "specify the maximum permissible stacking height to maintain the required clearances from the heater to combustibles." Space-Ray recommends posting these signs adjacent to the heater thermostat or other suitable location that will provide enhanced visibility.

## 20) GAS CONNECTIONS AND REGULATIONS

1. Connect to the supply tank or manifold in accordance with the latest edition of National Fuel Gas Code (ANSI Z223.1), and local building codes. Authorities having jurisdiction should be consulted before the installation is made. (In Canada, refer to the latest edition of CAN Standard B.149-1 & -2, Installation Codes for Gas Burning Appliances and Equipment.)
2. All gas supply lines must be located in accordance with the required clearances to combustibles below the heater as listed on the nameplate of the heater.
3. Pipe joint compounds must be resistant to the action of liquefied petroleum gases.
4. Straight tube heaters (LTS series) can expand/contract during operation. If rigid pipe connections are planned, provisions for expansion/contraction must be provided. Where local codes do not prohibit, a CSA or U.L. approved flexible connector (minimum 5/8" I.D.) is recommended between the rigid piping and the heater. A union and an approved shut off valve should be installed before the control valve inlet. The shut off valve should be installed within 6 feet of the union.
5. This appliance is equipped with a step-opening, combination gas valve. **The maximum supply pressure to the appliance is 14" W.C. or 1/2 P.S.I.** If the line pressure is more than the maximum supply pressure, then a second stage regulator which corresponds to the supply pressure must be used.
6. If a 2<sup>nd</sup> stage regulator is used and gas seeps through it, the redundant combination gas valve is designed to lock out. Pressure build-up in the supply lines prior to the heater must be released before proper heater operation.
7. After all gas connections have been made, make sure the heater and all gas outlets are turned off before the main gas supply is turned on. Turn the gas pressure on and check for leaks. To check for leaks, apply a soap suds solution to all connections and joints or check by one of the methods listed in Appendix D of the National Fuel Gas Code.

**! DO NOT USE AN OPEN FLAME OF ANY KIND TO TEST FOR LEAKS.**



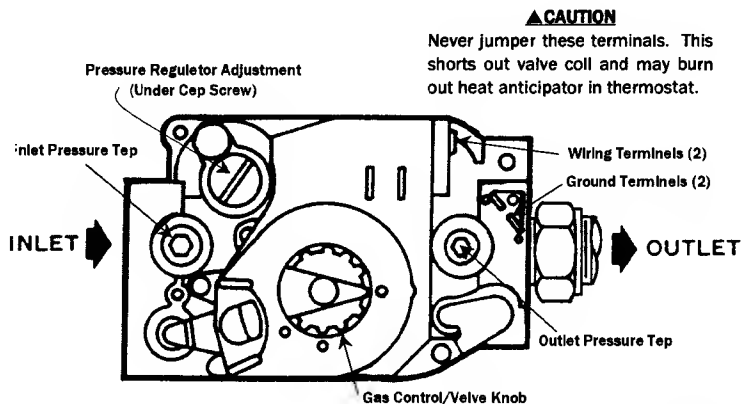
## 21) INSTRUCTIONS FOR PRESSURE TEST GAUGE CONNECTION

### ◆ Supply Pressure

1. The installer will provide a 1/8" N.P.T. plugged tapping, accessible for test gauge connection immediately upstream of the gas supply connection to the heater.

### ◆ Manifold Pressure

1. Turn the gas valve to the "OFF" position. Remove the 1/8" plug from the combination gas valve at the outlet pressure tap and connect a 1/8" nipple to the tapped hole. Connect the gauge to the nipple. Turn on the gas supply.
2. With the main burner operating, check the burner manifold pressure using a water manometer. Gauges that measure pressure in pounds per square inch are not accurate enough to measure or set the manifold pressure. All measurements **MUST BE** made when this heater and all other gas burning equipment that is connected to the gas supply system are operating at maximum capacity.
3. The combination gas valve is factory set and should not be adjusted. If full rate adjustment is required, remove the cover screw. Using a small screwdriver, turn the adjustment screw clockwise  $\curvearrowright$  to increase or counterclockwise  $\curvearrowleft$  to decrease the gas pressure to the burner. Replace the cover screw. **NOTE: The step opening pressure of this gas valve is not adjustable.**
4. Check the burner at step pressure, observing burner ignition and flame characteristics. The burner should ignite properly and without flashback to the orifice, and should remain lit. Cycle the burner several times. Wait 30 seconds between cycles to allow the



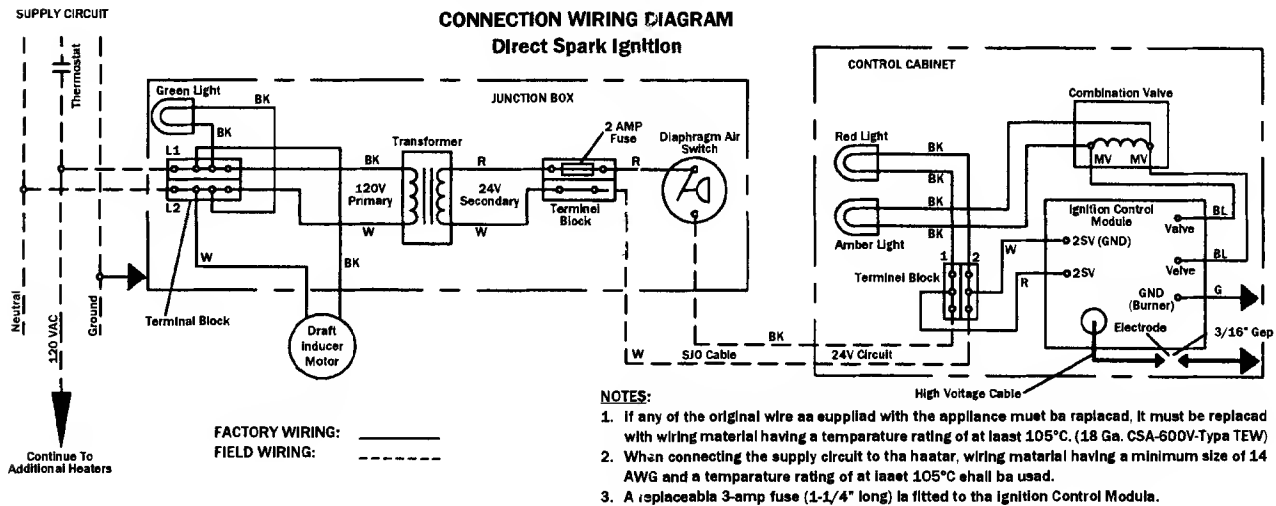
step opening combination gas valve or servo regulator to resume the first step action. Also, observe the burner operation at full pressure. Repeat after allowing to cool. (Gas pressures are shown in the following table.)

GAS PRESSURE TABLE			
GAS TYPE	MANIFOLD PRESSURE	SUPPLY PRESSURE	
		Minimum*	Maximum
Natural Gas	3.5" W.C.	5" W.C.	14" W.C.
Propane Gas	10.0" W.C.	11" W.C.	14" W.C.

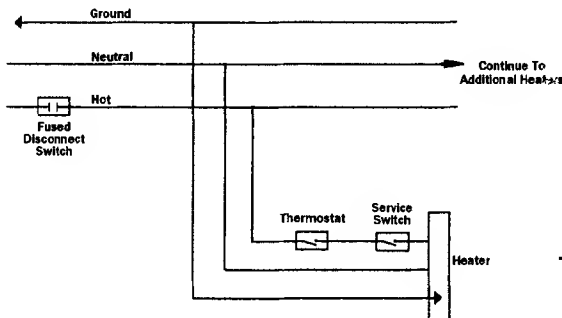
\* Minimum permissible gas supply pressure for purpose of input adjustment.

## 22) ELECTRICAL CONNECTIONS

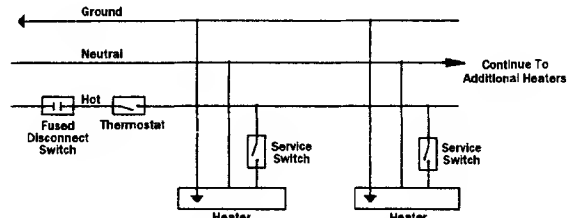
1. All electric wiring shall conform to the latest edition of the National Electrical Code (ANSI/NFPA No. 70), or the code legally authorized in the locality where the installation is made.
2. The unit must be electrically grounded in accordance with the National Electrical Code (ANSI/NFPA No. 70-latest edition). In Canada, refer to current standard C22.1 Canadian Electrical Code Part 1.
3. The wiring providing power to the heater shall be connected to a permanently live electrical circuit, one that is not controlled by a light switch.
4. The electrical power to the heater shall be through an approved fused disconnect switch. The switch shall be located in the vicinity of the heater (check local codes for allowable distances) and should be identified as the heater control switch. All electrical wiring must be located in accordance with the required clearances to combustibles below the heater as listed on the nameplate of the heater.
5. When connecting the supply circuit to the heater, wiring material having a minimum size of 14 AWG and a temperature rating of at least 105°C shall be used.
6. The installer will provide strain relief for the power supply wires at the junction box.
7. **LTS SERIES ONLY:** The installer will provide type SJO wire cable having minimum size of 18 AWG and connect the ends to the draft inducer junction box and the control box. Secure with 3/8" connectors as previously described in the attachment of the control box and draft inducer. Connect wire leads as shown in the Connection Wiring Diagram. The SJO cable should be located and secured to protect it from mechanical damage.



### Single Heater Per Thermostat



### Multiple Heaters Per Thermostat



TYPICAL WIRING AND THERMOSTAT CONNECTIONS

## 23) VENTING

**A. BASIC FLUE VENTING** — Venting must comply with the latest edition of the National Fuel Gas Code (ANSI Z223.1-latest edition) or the authority having jurisdiction. Other venting references are in the equipment volume of the ASHRAE Handbook.

### **SINGLE HEATER VENTING (VERTICAL THROUGH THE ROOF)**

1. When venting the heater to outside of building through a roof, use single-wall metal pipe. This is to be constructed of galvanized sheet metal or other approved noncombustible corrosion-resistant material as allowed by state or local codes.
2. A vent passing through a combustible roof shall extend through a 2-inch clearance roof thimble. Double-wall, Type B vent must be used for the portion of the vent system which passes through the roof. An approved vent cap (Leslie "VersaCap"-Type B) must be attached to end of the flue.
3. The maximum equivalent length of vent pipe should be carefully observed. A safety switch in the heater is designed to shut the heater off before excessive flue restriction causes bad combustion. Refer to the Vent Sizing Table at the end of this section for required vent pipe diameter.
  - Minimum Equivalent Length = 5 ft. of Pipe
  - Maximum Equivalent Length = 100 ft. of PipeUse the following correction factors to obtain the equivalent length:
  - a. Subtract 15 ft. if the run is horizontal.
  - b. Subtract 10 ft. for an approved vent cap.
  - c. Subtract 10 ft. for each elbow beyond 15 ft. from the heater.
  - d. Subtract 15 ft. for each elbow within 15 ft. of the heater.
4. Avoid locating elbows in the first 5 ft. of vent pipe whenever possible. Limit to (2) 90° elbows. When vent pipe is in a horizontal run, it must have 1/4 Inch per foot rise.
5. Joints between sections of piping shall be fastened by sheet metal screws or other approved means and should be sealed to prevent leakage of flue gas into building. Aluminum or Teflon tape suitable for 550°F (3M Company tapes 433 or 363) or silicone sealant is recommended.
6. All portions of the vent pipe shall be supported to prevent from sagging.
7. When the vent pipe passes through areas where the ambient temperature is likely to induce condensation of the flue gases, the vent pipe should be insulated and a condensation drain should be provided.
8. Minimum clearance for single-wall flue pipe to combustible material shall be 6 inches. This may be reduced when the combustible material is protected as specified in the National Fuel Gas Code or the authority having jurisdiction.
9. Single-wall metal pipe shall not originate in any unoccupied attic or concealed space and shall not pass through any attic, inside wall or concealed space, or through any floor. For the installation of a single-wall metal pipe through an exterior combustible wall, refer to latest edition of the National Fuel Gas Code or the authority having jurisdiction.
10. A venting system shall terminate at least 3 ft. above any forced air inlet located within 10 ft.

### **SINGLE HEATER VENTING (HORIZONTAL THROUGH SIDEWALL)**

When venting the heater horizontally through a combustible outside sidewall, the same requirements listed previously for venting **Vertical Through The Roof** apply except as follows:

1. A vent passing through a combustible wall must pass through a 2-inch clearance thimble (Air-Jet #4VT or #6VT or Ameri-Vent #4EWT or #6EWT) or other thimbles that are listed by a nationally recognized testing agency.
2. An approved vent cap (Bredert-Type L or equal) must be attached to the end of the vent pipe.
  - Minimum Equivalent Length = 5 ft. of Pipe
  - Maximum Equivalent Length = 75 ft. of Pipe**NOTE:** To minimize problems associated with condensation in long horizontal runs, vent pipe can be insulated.
3. When venting through a sidewall, the horizontal vent pipe shall rise not less than 1/4 inch per foot from the start of the vent system to the vent terminal. All portions of the vent pipe shall be supported to prevent sagging.
4. A minimum clearance of 6 inches must be maintained between the outside wall and vent cap.
5. The horizontal venting system shall not terminate:
  - a. Less than 4 ft. (1.2m) below, 4 ft. (1.2m) horizontally from or 1 ft. (30cm) above any door, window or gravity air inlet into any building. The bottom of the vent terminal shall be located at least 7 ft. (2.1m) above grade or above snow accumulation level as determined by local codes.
  - b. Less than 3 ft. (0.9m) from a combustion air inlet.
  - c. Less than 3 ft. (0.9m) from any other building opening or any gas service regulator.
  - d. Directly over areas where condensate or vapor could create a nuisance or hazard or be harmful to the operation of gas utility meters, regulators, relief valves, or other equipment. Building materials should be protected from flue gases and condensate.
6. In regions of the country where prevailing winds are consistently higher than 40 mph, it may be necessary to terminate the vent system above the roof level.

### **MULTIPLE HEATER VENTING (CONNECTIONS INTO A COMMON VENT OR MANIFOLD)**

Requirements for venting of multiple heaters are the same as described for **SINGLE HEATER VENTING** except as follows:

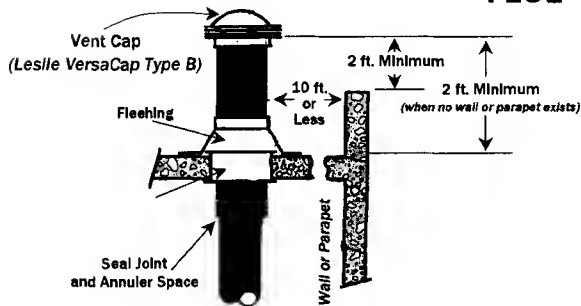
1. The common vent size and total vent height is normally determined by the number of heaters per common vent, length of horizontal connector runs, and connector rise. Connector lengths should be as short as possible and have a minimum 1/4" per ft. rise. Without regard to connector rise and total vent height due to many possible venting configurations, the following should be observed:
  - a. Common vent pipe & vent connector diameter should be no less than that shown in the following Vent Sizing Table.
  - b. The connector length should be no more than 75% of the vertical portion of vent above the connector.
  - c. Where possible, use a Y-connector to the common vent.

2. Material for connectors should be constructed of galvanized sheet metal or other approved noncombustible corrosion resistant material as allowed by state or local codes. All common vent pipe should be double wall, Type B vent.
3. Avoid unnecessary bends. Limit to two (2) 90° elbows.
4. The entire length of vent connector shall be readily accessible for inspection, cleaning and replacement.
5. Groups of heaters with a common vent must be controlled by a common thermostat.

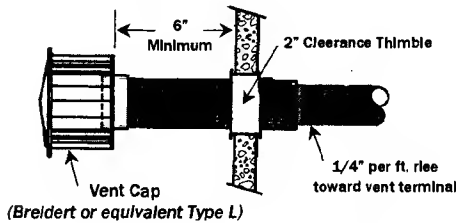
**▲WARNING: COMMON VENTING OF MULTIPLE HEATERS IN CONFINED SPACES IS PROHIBITED.** If any heater connected to a common vent system for multiple heaters is found inoperative, the heater should be disconnected from the vent system and its entrance into the vent system capped.

**B. INDIRECT VENTING (UNVENTED HEATERS)** — This heater requires ventilation in the building to dilute the products of combustion and provide fresh air for efficient combustion. Where unvented heaters are used, gravity or mechanical means shall be provided to supply and exhaust at least 4 CFM per 1,000 Btu/hr input of installed heaters. Exhaust vents must be located at the highest point above and in the vicinity of the heaters, and the inlet vents must be located below the level of the heaters. An exhaust hood (Part #42924040 for LTS40-75 or Part #42924000 for LTS/LTU80-175) must be placed directly on the flue pipe starting collar (4" starting collar for LTS40-75 or 4"x6" starting collar for LTS/LTU80-175) when used unvented and must be mounted only in an upright position and directed towards the reflector body.

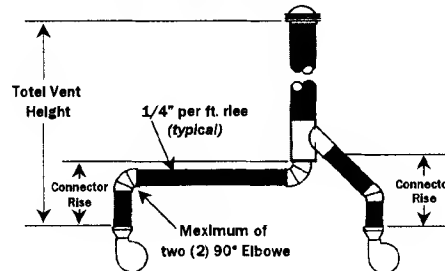
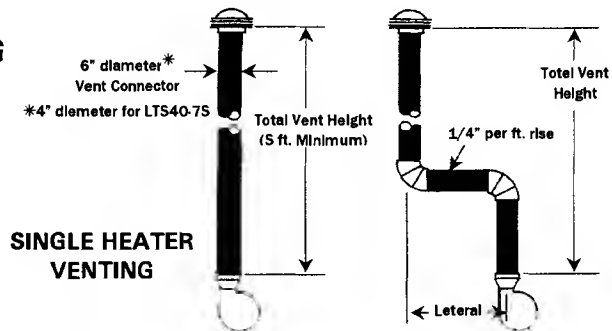
### BASIC FLUE VENTING



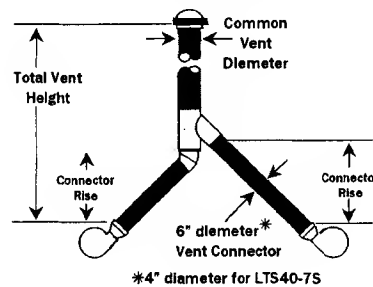
**Vertical Through the Roof**



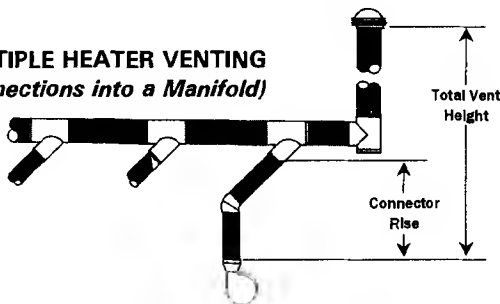
**Horizontal Through Sidewall**



**MULTIPLE HEATER VENTING  
(Connections into a Common Vent)**



**MULTIPLE HEATER VENTING  
(Connections into a Manifold)**



VENT SIZING TABLE	Number of Heaters				
	1	2	3	4	5
LTS/LTU 40 - 50	4"	4"	5"	5"	6"
LTS/LTU 60 - 75	4"	5"	6"	6"	7"
LTS/LTU 80 - 100	6"	6"	6"	7"	8"
LTS/LTU 110 - 130	6"	6"	7"	8"	9"
LTS/LTU 140 - 175	6"	8"	8"	9"	10"

#### COMMON VENT DIAMETER

**NOTE:** If a size is not available use the next larger size.

THE FOLLOWING ILLUSTRATIONS AND TABLE OF VENT SIZES FOR COMMON VENTING OF MULTIPLE HEATERS ARE IN ACCORDANCE WITH THE NATIONAL FUEL GAS CODE ANSI Z223.1-LATEST EDITION, NFPA #54-LATEST EDITION, EQUIPMENT VOLUME OF 1988 ASHRAE HANDBOOK, CURRENT CAN/CGA-8149.1/2-M86 INSTALLATION CODE, AND AGA PUBLICATION NO. 10MS.85 2.5-2 ON FUNDAMENTALS OF GAS APPLIANCE VENTING AND VENTILATION-REVISED BUT ARE NOT A PART OF THE CSA CERTIFICATION.



## 24) AIR FOR COMBUSTION

If indoor combustion air is to be supplied for a tightly enclosed area, one square inch of free area opening shall be provided below the heater for each 1,000 Btu/hr of heater input. Adequate clearances round the perforated fresh air plate must be maintained at all times. In larger open areas of buildings, infiltration normally is adequate to provide air for combustion.

## 25) DIRECT OUTSIDE AIR FOR COMBUSTION

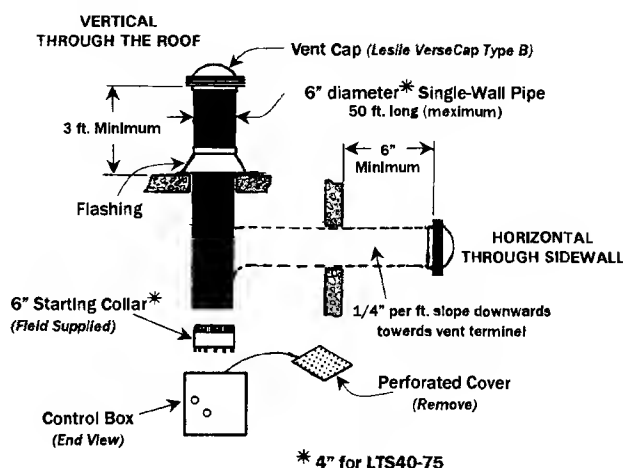
Outside combustion air should be supplied directly to the heater when the building is subject to negative pressure, contaminants or high humidity are present in the building air. These contaminants include paints, solvents, corrosive vapors or any other foreign particles that may cause damage to the heater or result in poor combustion.

Outside combustion air can be brought directly to the heater by a 6" diameter\* duct less than 50 ft. long or equivalent. This is attached to a 6" diameter\* starting collar. The starting collar is fitted to the top of the control cabinet **after first removing and discarding the perforated cover**. An approved vent cap must be placed directly on the end of the outside combustion air inlet pipe. The combustion air inlet should be a minimum of 3 ft. (0.9m), either vertically or horizontally, from the flue vent termination. The air intake terminal must be located not less than 1 ft. (30cm) above grade. It is good installation practice to supply combustion air from the same pressure zone as the vent outlet. Avoid bringing combustion air to the heater from an attic space. There is no guarantee that adequate combustion air will be supplied.

If the heater is installed less than 2 ft. from the ceiling, a flexible transition section (e.g., flexible aluminum duct) must be provided to allow for expansion/contraction of straight tube heaters (LTS series).

In colder climates, where necessary, insulate the outside combustion air duct. Avoid locating the outside combustion air duct directly above the control box. Provide a capped cleanout T as necessary. In high humidity applications, the control box should be sealed with silicone sealer.

In multiple heater applications, the combustion air intake may be ducted individually or common ducted in the same configuration as shown for venting in Section 23. For combustion air intake duct sizing, please refer to the **Vent Sizing Table** and use the diameter indicated, based on the number of heaters per duct.



## 26) LIGHTING AND SHUTDOWN INSTRUCTIONS

- 1) Turn on the gas supply.
  - 2) Set the thermostat to call for heat.
  - 3) Ignition should occur after the 30-second air purge.
  - 4) If ignition fails, the unit will spark for approximately 21 seconds and go into safety lockout. Turn the thermostat (power) off for 60 seconds to take the system out of lockout.
  - 5) If the heater does not light, shut off gas completely for 5 minutes before attempting to relight.
  - 6) **▲CAUTION:** The heater must be grounded. Poor grounding will give nuisance lockouts, particularly during momentary power interruptions.
  - 7) To shut down the heater, turn off the gas and the electrical supply.
- NOTE:** The Lighting and Shutdown Instructions are also shown on the permanent nameplate attached to the heater control box.

## 27) IGNITION SYSTEM CHECKS

### ➤ STEP 1: CHECK IGNITION CABLE.

- a) Make sure that the ignition cable does not touch any metal surface.
- b) Make sure that connections to the stud terminal and the igniter/sensor are clean and tight.
- c) Make sure that the ignition cable provides good electrical continuity.

### ➤ STEP 2: CHECK IGNITION SYSTEM GROUNDING.

(Nuisance shutdowns are often caused by a poor or erratic ground.) A common ground is required for the module, igniter, flame sensor and main burner.

- a) Check for good metal-to-metal contact between the igniter bracket and the main burner.
- b) Check the ground lead from the GND (BURNER) terminal on the module to the igniter bracket. Make sure connections are clean and tight. If the wire is damaged or deteriorated, replace it.
- c) Replace igniter/sensor with factory replacement part if insulator is cracked.

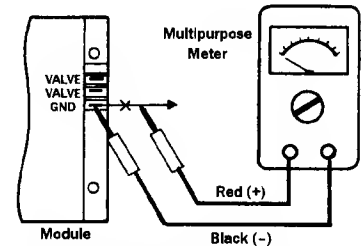
➤ **STEP 3: CHECK SPARK IGNITION CIRCUIT.**

**▲WARNING: THE IGNITION CIRCUIT GENERATES A 20,000 VOLT OPEN CIRCUIT AND ELECTRICAL SHOCK CAN RESULT.**

- Check ignition cable.
- Check external fuse on the module.
- Verify power (24V) at module input terminals and output terminal to gas valve.
- Replace spark module if fuse and power are OK.

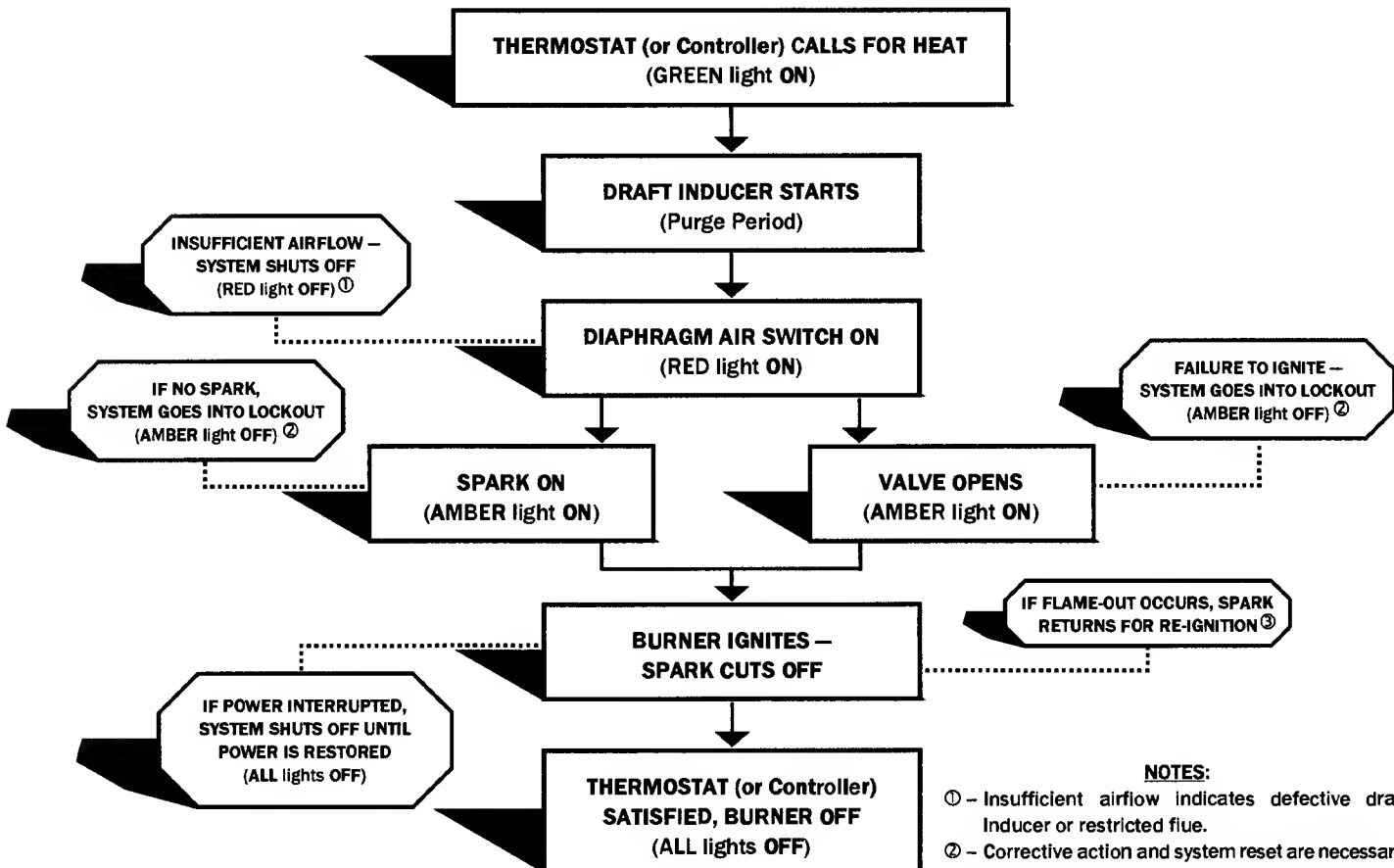
➤ **STEP 4: CHECK FLAME SENSOR CIRCUIT.**

- Turn off heater at thermostat.
- Connect a meter (dc microammeter scale) in series with the ground lead as shown in the diagram. Use a Honeywell W136 Test Meter or equivalent. Connect the meter as follows:
  - Disconnect the ground lead at the electronic control.
  - Connect the black (negative) meter lead to the electronic control GND terminal.
  - Connect the red (positive) meter lead to the free end of the ground lead.
- Restart the system and read the meter. The flame sensor current must be steady and measure at least 1.5 micro amps.
- If the meter reads less than the minimum or if reading is unsteady:
  - Make sure burner flame is capable of providing a good rectification signal.
  - Make sure fasteners securing igniter/sensor are tightened to assure correct positions. DO NOT relocate igniter/sensor.
  - Check for excessive (over 1000°F) temperature at ceramic insulator on flame sensor. Excessive temperature can cause short to ground. DO NOT relocate igniter/sensor.
  - Check for cracked ceramic insulator, which can cause short to ground, and replace sensor if necessary.
  - Make sure that electrical connections are clean and tight. Replace damaged wire
- Remove microammeter and reconnect ground wire. Return system to normal operation.



**FLAME SENSOR CURRENT CHECK**  
- USE  $\mu$ A SCALE -

**28) SEQUENCE OF OPERATION**



**NOTES:**

- ① - Insufficient airflow indicates defective draft Inducer or restricted flue.
- ② - Corrective action and system reset are necessary.
- ③ - If burner does not re-ignite, system goes into lockout. Corrective action and system reset are necessary.

**ERROR**

-- Octagons represent actions resulting from possible malfunction.

## 29) TROUBLESHOOTING GUIDE OF DIRECT SPARK IGNITION SYSTEM

-START-

**TURN GAS SUPPLY ON. SET  
THERMOSTAT TO CALL FOR HEAT.**

**Power To Control Module?  
(25 vac nominal)**

**No**

- ✓ Check line voltage.
- ✓ Low voltage transformer.
- ✓ Thermostat and wiring.
- ✓ Diaphragm air switch.

**Yes**

**Ignition Module 30-Second  
Delay For Prepurge?**

**No**

- ✓ Check fuse and replace if necessary.
- ✓ Replace module if fuse checks okay.

**Yes**

**Spark Across igniter or  
Igniter/Sensor Gap?**

**No**

- ✓ Turn off gas supply.
- ✓ Pull ignition leads and check spark at ignition stud.

**Spark Okay?**

**No**

**Yes**

- ✓ Check ignition cable, ground wiring, ceramic insulator and gap (3/16") and correct.
- ✓ Check boot of the ignition cable for signs of melting or buckling.

**Yes**

**Main Burner Lights?**

**No**

- ✓ Check for 25 vac across valve and valve terminals on ignition module. If no voltage, replace module.
- ✓ Check electrical connections between ignition module and gas control. If okay, replace gas control.

**Yes**

**Spark Stops when Burner  
is Lit?**

**No**

**! NOTE: If module goes into lockout, reset system.**

- ✓ Check continuity of sensor cable and ground wire.
- ✓ Check that burner flame covers electrode.
- ✓ If checks are okay, replace ignition module.

**Yes**

**System Runs Until Call  
for Heat Ends?**

**No**

**! NOTE: If module goes into lockout, reset system.**

- ✓ Check continuity of sensor cable and ground wire.  
**NOTE:** If ground is poor or erratic, shutdowns may occur occasionally even though operation is normal at time of checkout.
- ✓ Check that burner flame covers electrode.  
**NOTE:** Temperature above 1000°F (538°C) causes short to ground.
- ✓ If checks are okay, replace ignition module.

**Yes**

**Call for Heat Ends and  
System Shuts Off?**

**No**

- ✓ Check for proper temperature controller operation.
- ✓ Remove valve lead at module. If valve closes, recheck temperature controller and wiring. If not, replace gas control.

-END TROUBLESHOOTING-

REPEAT PROCEDURE UNTIL TROUBLE-FREE OPERATION IS OBTAINED.

### 30) MOTOR AND BLOWER WHEEL CHECK

If draft inducer motor fails to run: A) Check power supply to junction box. B) Check for loose or broken motor lead wire. C) Check to see that blower wheel turns freely and is not rubbing housing. Blower wheel may have worked loose from shaft and jammed against housing. D) Check for blower wheel damage; replace if necessary. If no damage, readjust blower wheel on shaft & retighten set screw. E) If all above does not correct, replace motor.

### 31) CLEANING AND ANNUAL MAINTENANCE

This heater must be cleaned and serviced annually before the start of each heating season and at any time excessive accumulation of dust and dirt is observed. Maximum heating efficiency and clean combustion will be maintained by keeping the heater clean. To clean the heater, follow these instructions: 1) Turn off all electrical and gas supply to the heater. 2) Open the control box access panel. 3) Clean the access panel, the inside of the control box, the emitter tube and the reflector panels. (Dirty reflectors will reduce output.) 4) Visually inspect the spark electrode. Remove any foreign objects from electrode tip. Set the spark gap to the proper value of 3/16". **!CAUTION: The ceramic portion of the electrode is very fragile so any cleaning or adjustments must be done with care.** 5) Disconnect the vent stack and remove any foreign material that may have collected on the blower wheel. Make sure the blower wheel is clean. A dirty wheel can reduce the volume of air pulled and can result in premature tube failure.

### 32) REPLACING PARTS

Ensure that at all times when parts are being replaced, both gas and electrical supplies are disconnected. Various parts are available from the factory for replacement by a licensed person. Refer to the Replacement Parts Guide in Section 34 for all replacement parts.

### 33) INSTALLATION DATA

Date of Installation: \_\_\_\_\_ # of Heaters In System: \_\_\_\_\_  
Serial No. \_\_\_\_\_  
Model: LTS or LTU \_\_\_\_\_ N = Natural Gas  
L = Propane Gas

### 34) REPLACEMENT PARTS GUIDE

# DRAFT INDUCER COMPONENTS

# MODELS: LTS40-175 and LTU80-175

ITEM NO.	PART NO.	DESCRIPTION
1	42917010	Draft Inducer Assembly
3	03723020	Blower Wheel
4	03977120	Plastic Vacuum Air Tube, 12" long
5	42739010	Blower Housing Sub-Assembly
6	42740000	Motor Plate
7	42742000	Sensing Tube Bracket
8	42744000	Sensing Tube, Draft Inducer
9	30347000	Motor Spacer (4 per motor)
10	03868010	3/8" Connector
11	30186072	Air Switch Kit, set @ 0.37" W.C., #824
13	30267000	½" Knockout Plug
14	30279000	Transformer, AT120B1051
15	30281000	Terminal Block, EK-204
16	30330000	Terminal Block, TFB-323
17	42709000	Terminal Block Shield
18	30220010	Monitoring Light, Green
19	02175040	Strain Relief
20	42886000	Sensing Tube, Air Switch
21	42909000	Junction Box
22	42910000	Junction Box Cover
23	42911000	Junction Box Support Bracket
24	42923000	SJO Cable Assembly
25	03721000	Motor, JB1R061N
26	03979000	Braided Fiber Glass Sleeving, 4" Lg
27	43221000	Draft Inducer Gasket
28	42874000	Connection Wire Diagram (not shown)
29-38	Restrictor Plates, see Inset	

## NOTES:

- 1) Screws, Nuts and Washers are standard hardware items and can be purchased at any local hardware store.
- 2) Please order by **PART NUMBER** - not by *Item Number*.
- 3) Replacement Part Prices are available when ordering.
- 4) Please refer to complete Model Number when ordering.

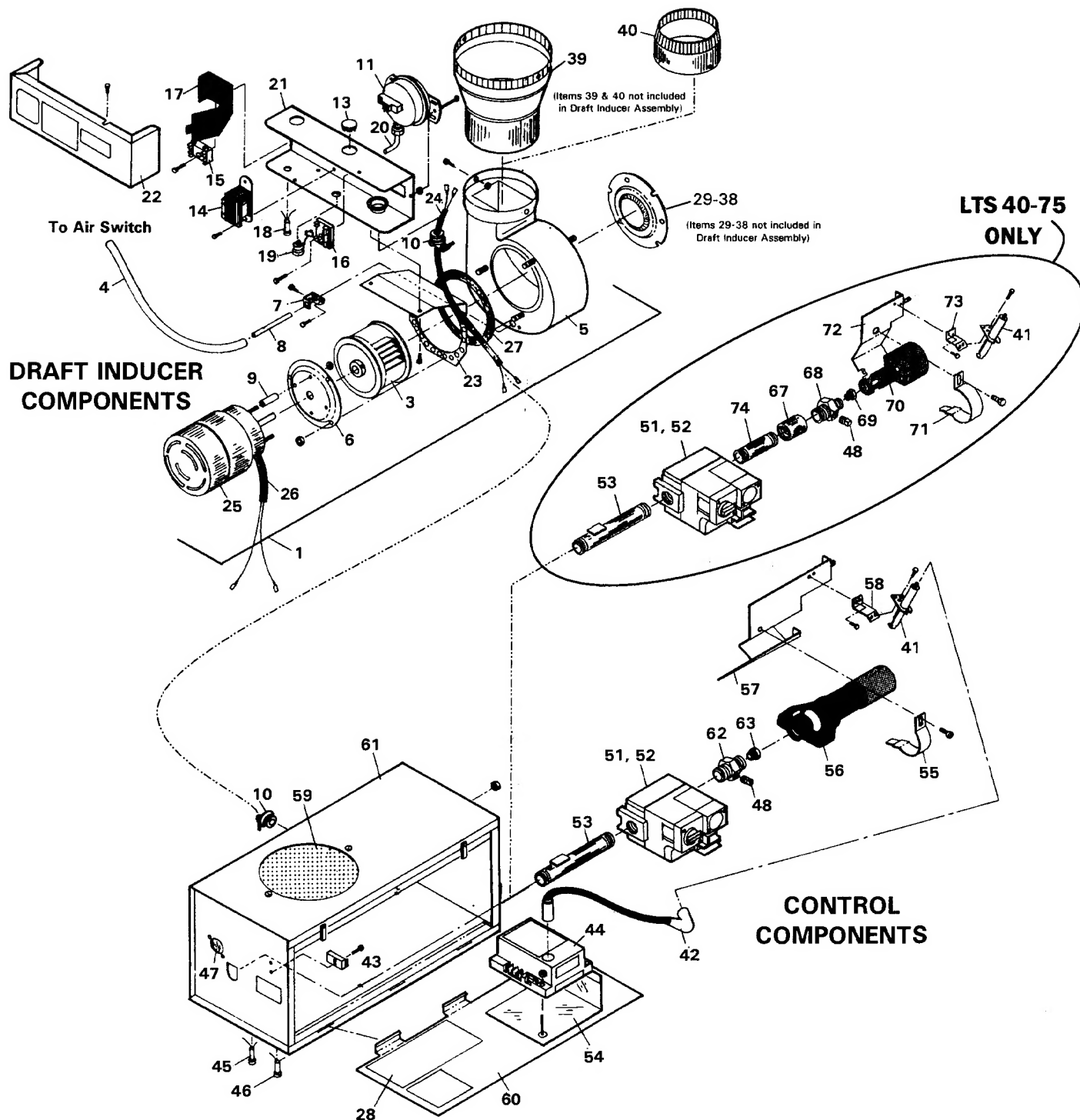
## Model Number Suffixes

- N = Natural Gas
- L = Propane Gas
- 5 = Direct Spark Ignition of Main Burner

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ITEM #	PART NO.	DESCRIPTION
29	42741040	Restrictor Plate, 1" I.D. (40M Btu/hr)
30	42741030	Restrictor Plate, 1-1/8" I.D. (50M Btu/hr)
31	42741020	Restrictor Plate, 1-7/32" I.D. (60M Btu/hr)
32	42741010	Restrictor Plate, 1-7/16" I.D. (75M Btu/hr)
33	42741050	Restrictor Plate, 1-1/2" I.D. (80M & 90M Btu/hr)
34	42741060	Restrictor Plate, 1-5/8" I.D. (100M Btu/hr)
35	42741070	Restrictor Plate, 1-3/4" I.D. (110M & 120M Btu/hr)
36	42741080	Restrictor Plate, 1-7/8" I.D. (125M & 130M Btu/hr)
37	42741090	Restrictor Plate, 2-1/32" I.D. (140M & 150M Btu/hr)
38	42741100	Restrictor Plate, 2-1/4" I.D. (160M & 175M Btu/hr)

39	42892000	Starting Collar, 4" x 6" (80M-175M Btu/hr)
40	40504020	Starting Collar, 4" (40M-75M Btu/hr)



### CONTROL COMPONENTS

MODELS: LTS40-175 and LTU80-175

ITEM NO.	PART NO.	DESCRIPTION
10	03868010	3/8" Connector
28	42874000	Connection Wire Diagram (not shown)
41	30295000	Electrode PSE-GF1 (Igniter/Sensor)
42	30314120	Ignition Cable, 14" long
43	30324000	Terminal Block, EK-104
44	30331040	Spark Module, S87J-1034
45	30220020	Monitoring Light, Red
46	30220030	Monitoring Light, Amber
47	42447000	Sight Glass
48	03339020	1/8" Plug
51	30333070	Valve, VR8205P-2408 @3½" w.c. (Natural Gas)
52	30333080	Valve, VR8205P-2416 @10" w.c. (Propane Gas)

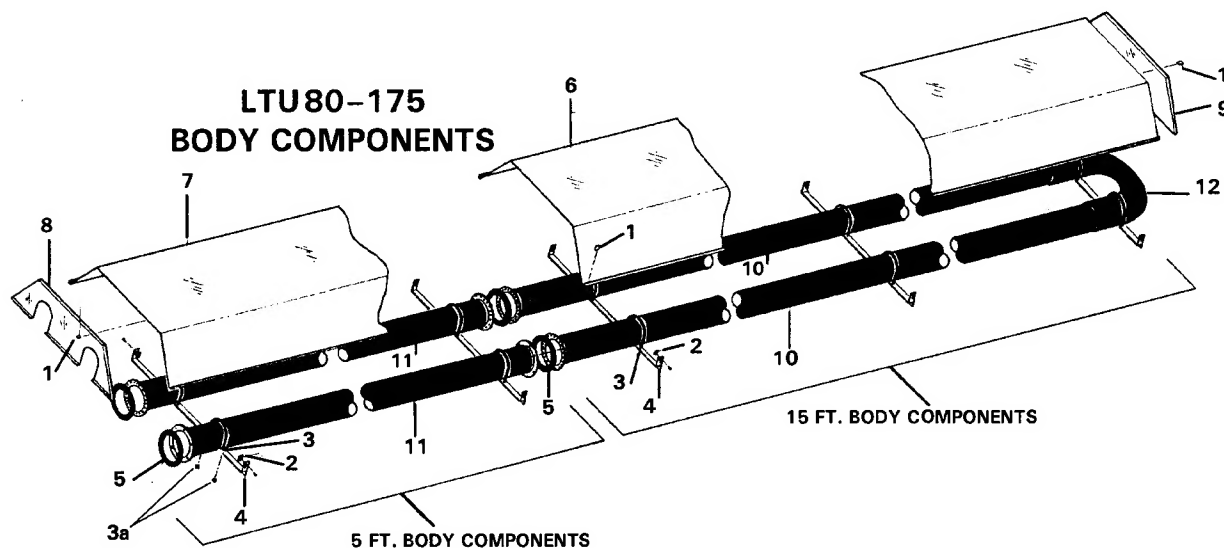
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**CONTROL COMPONENTS (Continued)**
**MODELS: LTS40-175 and LTU80-175**

ITEM NO.	PART NO.	DESCRIPTION
53	42757010	Restrainer Nipple, 4" long
54	42885000	Spark Module Shield
55	42887000	Burner Clamp
56	42890010	Burner Assembly
57	42899000	Burner Bracket Sub-Assembly
58	42888000	Electrode Bracket
59	42893000	Air Inlet Plate (Perforated)
60	42905000	Access Panel
61	42906000	Cabinet Assembly
62	42889000	Orifice Fitting & Test Gauge Connection
63	03258XXX	Orifice for LTS/U 80-175 (State Model & Gas Type for Size)
64	43155010	Installation and Operation Instructions
67	03540090	Coupling, 1/2"
68	42701000	Orifice Fitting & Test Gauge Connection
69	03259XXX	Orifice for LTS40-75 (State Model & Gas Type for Size)
70	42700000	Burner
71	43169000	Burner Clamp
72	43172000	Burner Bracket Sub-assembly
73	43170000	Electrode Bracket
74	03333120	Nipple, 1/2"x3 1/2" long

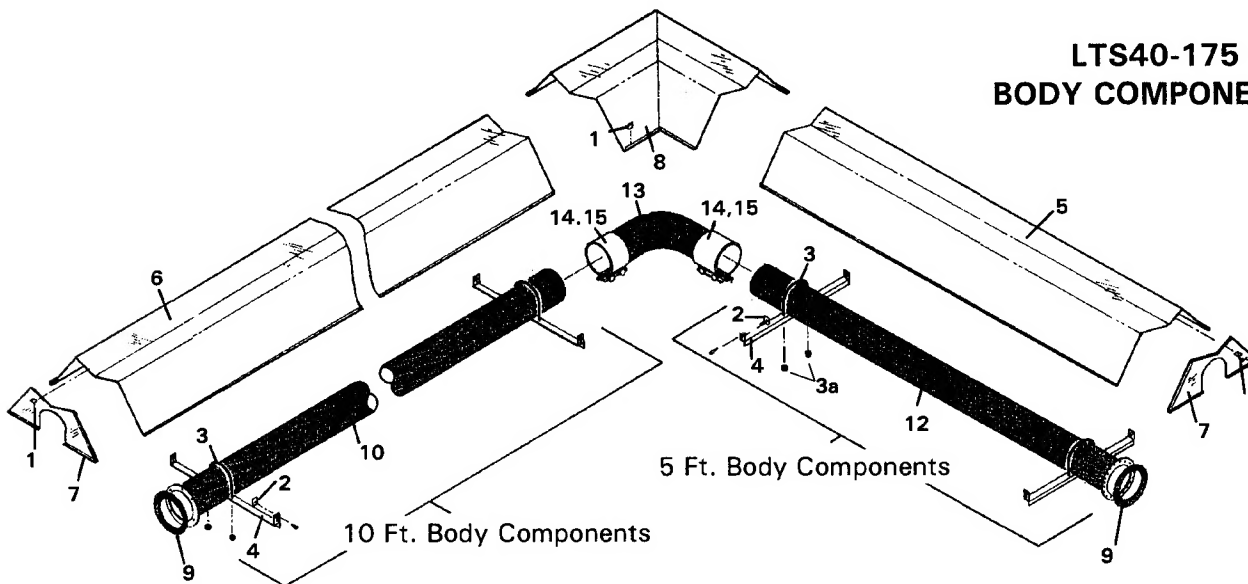
**LTU BODY COMPONENTS**
**MODELS: LTU 80-175**

ITEM NO.	PART NO.	DESCRIPTION
1	02266010	Reflector Speed Clip
2	42769011	Reflector Clamp with screw
3	42873000	"U" Bolt Clamp, 4" OD Tube
3a	02127110	"U" Bolt Hex Nut, 5/16-18 (2 per "U" Bolt) —Need Both
4	42898000	Tube Support/Hanger Bracket, 28" (5 per heater)
5	42921000	Tube Flange Gasket
6	42894080	Reflector, 8'-4" long (2 per heater; 15' section only)
7	42894100	Reflector, 9'-11 1/2" long (1 per heater; 10' section only)
8	42895000	Reflector, control end
9	42896000	Reflector, foot end
10	42912010	15' Tube Assembly, 4" OD, ALC w/one 24-hole flanges (firing tube)
11	42912130	5' Tube Assembly, 4" OD, ALC w/two 24-hole flanges —for LTU125-175
12	42913000	U Bend, 4" OD x 6" centerline radius



**LTS BODY COMPONENTS**
**MODELS: LTS40-175**

ITEM NO.	PART NO.	DESCRIPTION
1	02266010	Reflector Speed Clip
2	42769011	Reflector Clamp with screw
3	42873000	"U" Bolt Clamp, 4" OD Tube
3a	02127110	5/16-18 Hex Nut (2 per "U" Bolt) ) Need Both
4	43318000	Tube Support/Hanger Bracket -- 13" (2 per 5 ft. or 10 ft. body section)
5	43319050	Reflector -- 4'-11½" long (5' section only; 1 per 5 ft. body section)
6	43319100	Reflector -- 9'-11½" long (10' section only; 1 per 10 ft. body section)
7	43320000	End Reflector (2 per heater)
8	43342000	Corner Reflector Package
9	42921000	Tube Flange Gasket
10	42912080	10' Tube Assembly, 4" OD, ALC w/one 24-hole flange (start/end tube)
11	41932100	10' Tube Assembly, 4" OD, ALC w/out flange (extension tube)
12	42912100	5' Tube Assembly, 4" OD, ALC w/one 24-hole flange (exhaust tube)
13	43208010	4" O.D. Elbow Package
14	02189020	#10 x ½" Self-Drilling Screw (2 per coupling) ) Need Both
15	30462980	4" OD Tube Compression Coupling w/bolts

**LTS40-175  
BODY COMPONENTS**


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